Construction Methods

May
1934

This Month:

An issue featuring

SMALL AND MEDIUM-SIZED JOBS

McGraw-Hill Publishing Company, Inc.

Concreting rigid frame bridges on Northern State Parkway Long Island, N. Y.

THE FASTEST, CHEAPEST HANDLING SYSTEM.

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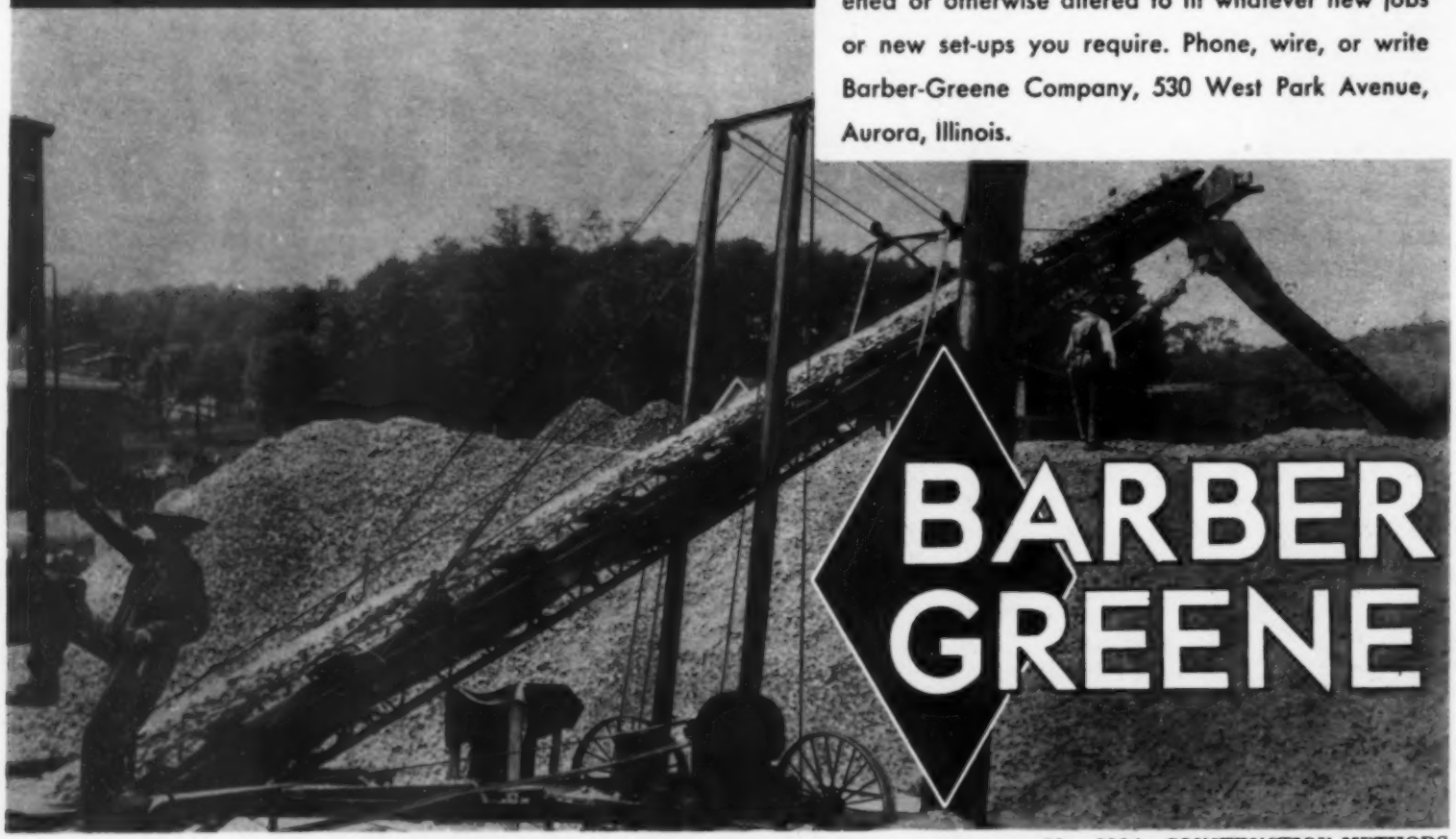
And the B-G Conveyors can be lengthened, or shortened or otherwise altered to fit whatever new jobs or new set-ups you require. Phone, wire, or write Barber-Greene Company, 530 West Park Avenue, Aurora, Illinois.



Construction Methods

MAY 1934

McGraw-Hill Publishing Company, Inc.,
330 West 42nd St., New York

WILLARD CHEVALIER,
Vice-President

ROBERT K. TOMLIN, Editor
Editorial Staff: Vincent B. Smith, N. A. Bowers (San Francisco)
Leonard H. Church (Cleveland), Nelle Fitzgerald

Featuring Small and Medium-sized Jobs

● Comparatively few construction men, especially in these times, have the opportunity of serving on the large, costly and spectacular projects that engage public interest through newspaper headlines. For every man employed on the Boulder Dam, the Rockefeller Center building group or the Golden Gate Bridge there are hundreds of others directly concerned with the less dramatic but equally essential small or medium-sized project. These men, in the course of their daily work, think in terms of thousands, rather than of millions, of dollars. Yet their problems of planning, selection of plant and materials, maintenance of progress schedules and control of construction costs are just as real and just as important, proportionately, as are those of the bigger and more widely publicized projects.

In this issue of *Construction Methods,* therefore, particular emphasis is placed upon the ordinary, "run-of-mine" operation which the average contractor or engineer is called upon to direct. An effort has been made to illustrate a variety in kinds of work encountered in the typical local improvement program: Small bridges for grade crossing elimination, a waterworks intake pipe line, a reservoir formed by a low earth-fill dam, a post-office building, a sewage plant enlargement, street paving, construction of a church, highway embankment across a park lake and details of concrete curbing. Prosaic subjects, to be sure, but the kind of jobs that mean bread and butter to the rank and file of the construction industry.

Code Interpretations

● Construction's Code Authority is functioning and has already issued half a dozen explanations or interpretations of code requirements. Among them are the following:

Awarding Authority

● The architect is not an awarding authority, within the meaning of the Code, when he merely takes bids and submits them to the owner. In this case the owner is the awarding authority.

Rejecting Bids

● Nothing in the Code relating to contract awards or rejection of bids (Article VII, Section 10) shall deprive the contractor of existing rights to reject any or all bids from subcontractors. It is not mandatory to subcontract with a mason contractor (as it happened to be in the case ruled upon) from whom bids are invited; the contractor has the right either to do the work himself or await the expiration of 90 days and invite new bids.

Is He Coming Off His Perch?

Talburt, in the Scripps-Howard Newspapers

Naming Subcontractors

● An awarding authority may require the naming of subcontractors only after, not before, the opening of bids.

Invitation to Bid

● Bids received from uninvited general contractors, as well as from uninvited subcontractors, (as provided in Article VII, Section 7 of the Code) must be returned unopened.

A manufacturer of construction material requested a ruling on a case involving Article VII, Section 7, stated as follows: "It has been customary in the past to obtain from the architect or from other sources, a list of all general contractors bidding on a project and to furnish all of these bidders with a bid, as in our case, for terra cotta, whether the contractors have actually solicited a bid or not. Many contractors with whom we deal do not bother to send cards of inquiry, but rely upon us to ascertain that they are bidding and supply them with a figure." The Code Authority has ruled that the facts above stated do not constitute an invitation to bid and cites the Code requirement that "bids received from uninvited bidders must be returned unopened."

In answer to a query as to whether a general contractor must invite bids specifically from each subcontractor, the Code Authority states that nothing prevents a general contractor from extending a general invitation for bids.

PWA Order Bans Bid Shopping

● In an effort to minimize the common practice of bid shopping for subcontracts on the part of contractors after the opening of bids, the PWA has issued an order signed by Administrator Ickes to all state engineers of the Public Works Administration. The order reads as follows:

"Every contractor who bids upon a project financed in whole or in part by loans or grants from the PWA shall submit in a sealed envelope with his bid to the contracting authority the names of all subcontractors and their bids upon which his bid is based. The sealed envelope so submitted shall have on it the name of the contractor with the words thereon 'Bids of Subcontractors.' Such submission shall be deemed to constitute an acceptance by the contractor, if awarded the contract, of the bid of each subcontractor. Any alteration therein, after the award of the contract, shall be subject to the approval of the contracting officer of the federal department or agency concerned."

New Men on Old Machines

● Equipment maintenance difficulties face the contractor who bids in a PWA project or other contract requiring that his own mechanics and operators be supplanted by local men. Some hazard is created by the need for alternating two shifts per week, but this danger is no greater than that commonly guarded against when operating two shifts per day. The real source of trouble lies in hiring strangers to operate the machines.

In his fleet of eight large earth-moving trucks a road contractor recently suffered two broken rear axles in one week. The breaks were not the fault of the trucks, he explained. Rather, the blame rested with the local drivers, hired for the job, who were either too lazy or too careless to shift into lowest gear when starting a load away from the shovel. The axles were not built for that kind of punishment.

No certain rule can be suggested for transforming new workmen into loyal employees overnight. If time and opportunity permit, a firm friendly talk before putting a man to work may instill some sense of loyalty and responsibility. If this medicine fails to take effect, only prompt discharge of the careless workers can weed out the undesirables in a new organization. As in the case mentioned, this method will be effective in reinforcing the cooperative spirit of the better workmen. But the stimulus came too late to save the broken axles.

The Way Out

LAST SEPTEMBER this page sounded a warning against reliance on high wage scales and short work days to relieve distressed workers in construction and other capital industries. It pointed out that these industries are not governed by the same factors that control demand for consumer goods and that it is futile to prescribe high wage scales in face of no demand or to spread employment that does not exist. Higher wages for workers in the consumer industries are quickly reflected in heavier demand for goods of their own making, but they generate no such demand for capital goods and services. Higher wage scales for construction workers, on the other hand, are very likely to be just as quickly reflected in a *diminished* demand for their services.

For that demand is governed by wholly different factors, of which two of the most important are (1) reasonable construction costs and (2) confidence in the outlook for a return on capital investment.

Today it is worth while to recall and repeat that warning. Under the provisions of the Construction Code the various divisions now are in process of negotiating area agreements as to wages and working conditions. Their representatives have it in their power to influence materially the rate at which employment and purchasing power will be restored to their people. If at this time they set wage scales too high they will learn that a high rate multiplied by zero hours still confers zero purchasing power. If they shorten hours to a point where waste and inefficiency unduly swell over-all costs there will be no employment to spread.

With all due allowance for the fiat employment that may be created through PWA, the fact remains that we can have no general betterment in the construction industries until private capital once again is drawn into investment. Prohibitive construction costs will be no encouragement to that essential process.

Few construction employers begrudge their labor a decent wage; few would impose unreasonable working conditions. From the nature of the construction industry there is more than the usual community of interest between employers and employees in this vital matter. It is not at all a question of gouging or sweating. Both of them are wholly dependent upon the resumption of capital investment for their chance to survive and prosper and at this time both have an equal interest in practicing whatever self-sacrifice may be necessary to stimulate the flow of capital into new construction.

At this time there is evidence of an awakening confidence that bodes well for a resumption of investment. We shall be wise, therefore, to nourish these frail beginnings and not smother them under the menace of fictitious scales that can have no practical significance until work actually is available. The representatives of labor can help to this end in the drafting of area agreements; employers can help in their allowance for profit margins in their bids. Here is a joint responsibility, if we are to realize a joint opportunity to participate in the early revival of an industry that means so much not only to those engaged in it but also to the country as a whole.

Just as truly as they were last September, these are the essentials to keep before us at this time:

1. Maintain and strengthen the Public Works program, which is the one certain source of demand for construction goods and services until such time as private investment takes hold.

2. Remove any unreasonable legislative restraints that now deter the entrance of private capital into legitimate enterprise.

3. Let both labor and employers cooperate to keep construction costs at reasonable levels and thereby encourage capital to seek investment.

If these objectives can be achieved there is ample ground for hope that the construction industry will soon be well on the way to recovery. Here is an opportunity for industrial statesmanship on the part of both employers and employees.

Willard Chevalier

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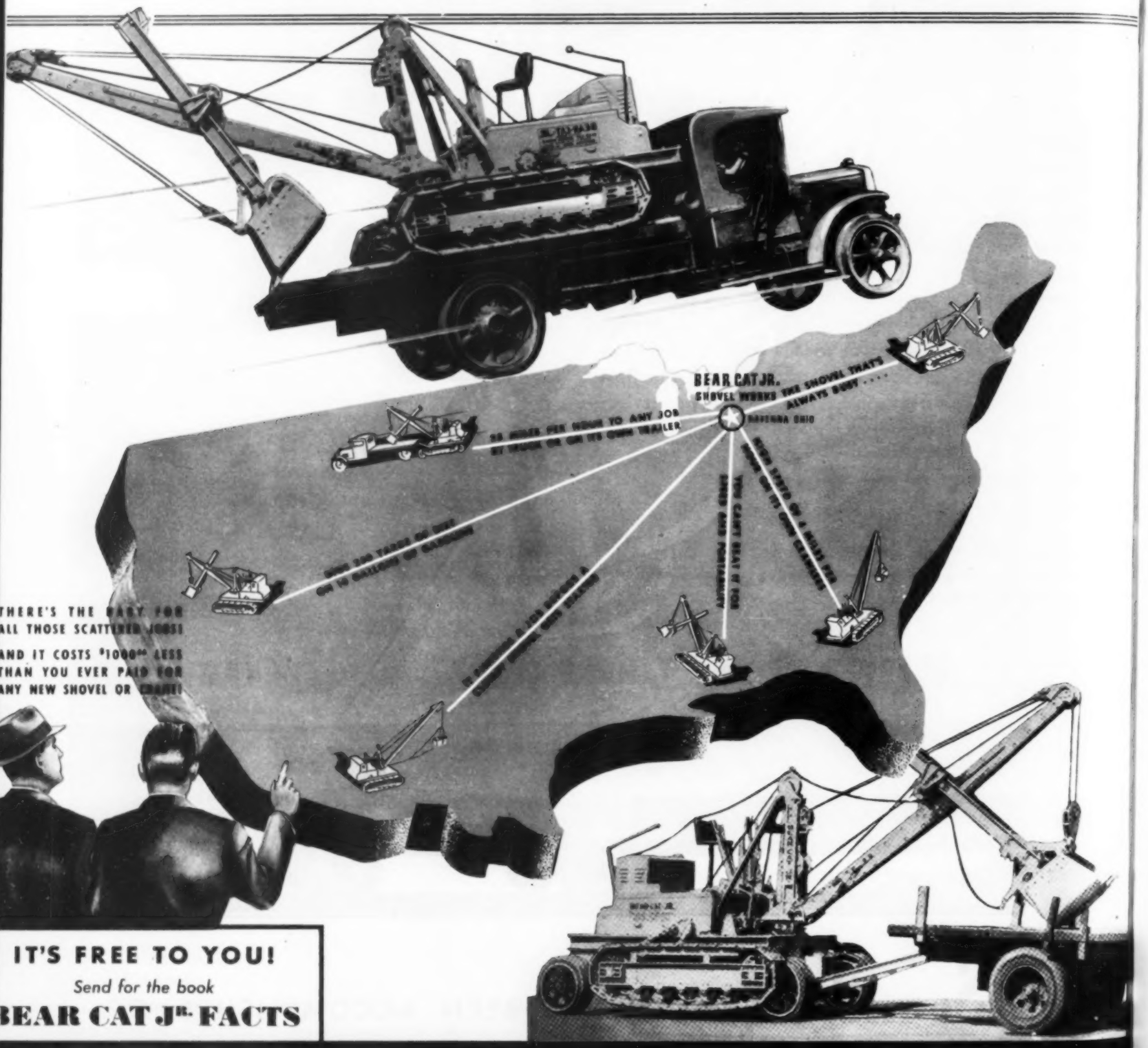
are **GETTING WISE** *to*

THE PROFIT POSSIBILITIES OF THIS SHOVEL



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Old and new Handles and Heads are interchangeable.

"What a whale of a wrench the **"FAVORITE"** *is now!"*

A DOUBLE TWIST
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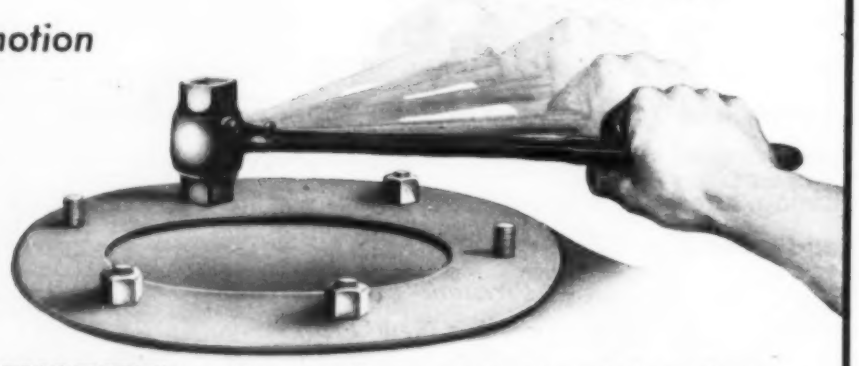
This new metal was tested in the laboratory under severe pressure, to ascertain its breaking point, but the wrench merely twisted twice in two directions without breaking, as shown in the phctograph.

Even the pawl and ratchet walls were not damaged.

A time-saving tool

all lost motion avoided



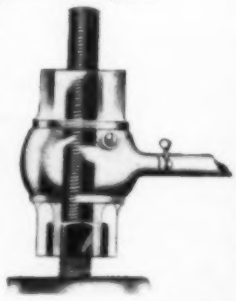
The "FAVORITE" reduces the cost of nut turning

It works on a quick, straight-ahead ratchet movement, and the socket form of head is not removed from the nut until operation is completed.

This is a great saving in time over the old-fashioned, open-end type, which must be removed from nut at every quarter turn, with the possibility of slipping.

Reverse motion instantaneous by simply turning pawl.

Can be used in narrower places than an ordinary wrench.



Opening in head allows bolt to pass clear through.

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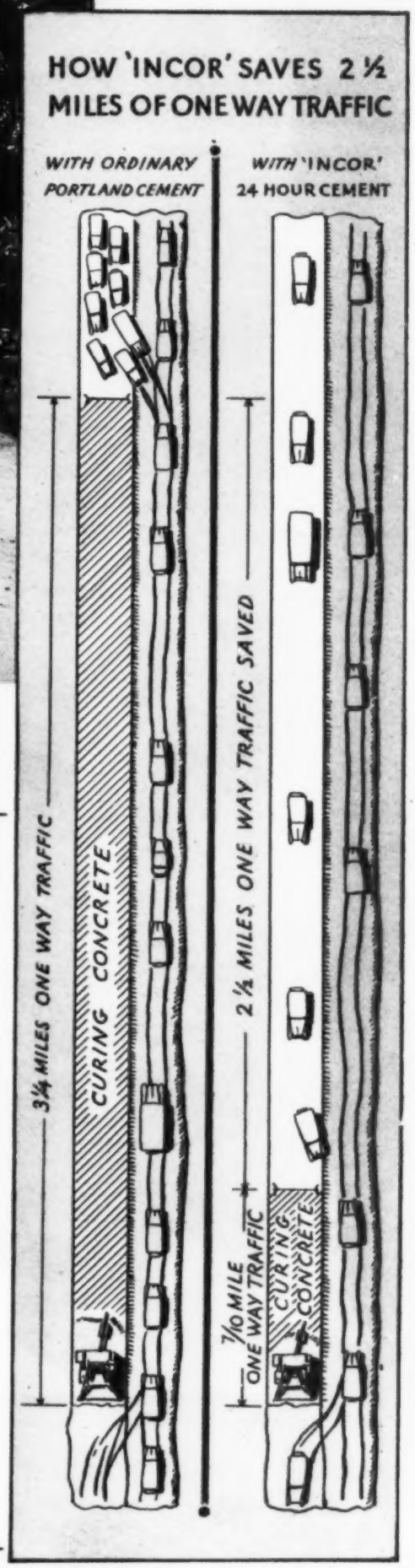
The Midland Bus Came Through on Time

A MIDLAND BUS, bound for St. Louis, rolling over new pavement on U. S. Route No. 12 near Clay City, Illinois. Road repaved in half-width sections, obviating use of bad detour 13 miles longer than main route, over rough, narrow roads. Made possible by good planning and the use of 'Incor' 24-Hour Cement.



24-Hour Cement Eliminates Detours by Half-Width Construction

Detours place a heavy cost-penalty on traffic—due to greater distance traveled, poor condition of road surface, confusion and lost time. The best solution is to keep the main highway continuously open. With 'Incor' 24-Hour Cement this is easily possible. Only where short, paved side-roads are available, or where unusually heavy excavation is necessary, are detours required.

With ordinary Portland cement, one-way traffic through the job is necessary over 3¼ miles of roadway (laying 1800 feet of half-width pavement per day, 10 days' curing); with 'Incor', one-way traffic is reduced to 7/10th mile (laying 1800 feet a day, *24 hours' curing*).

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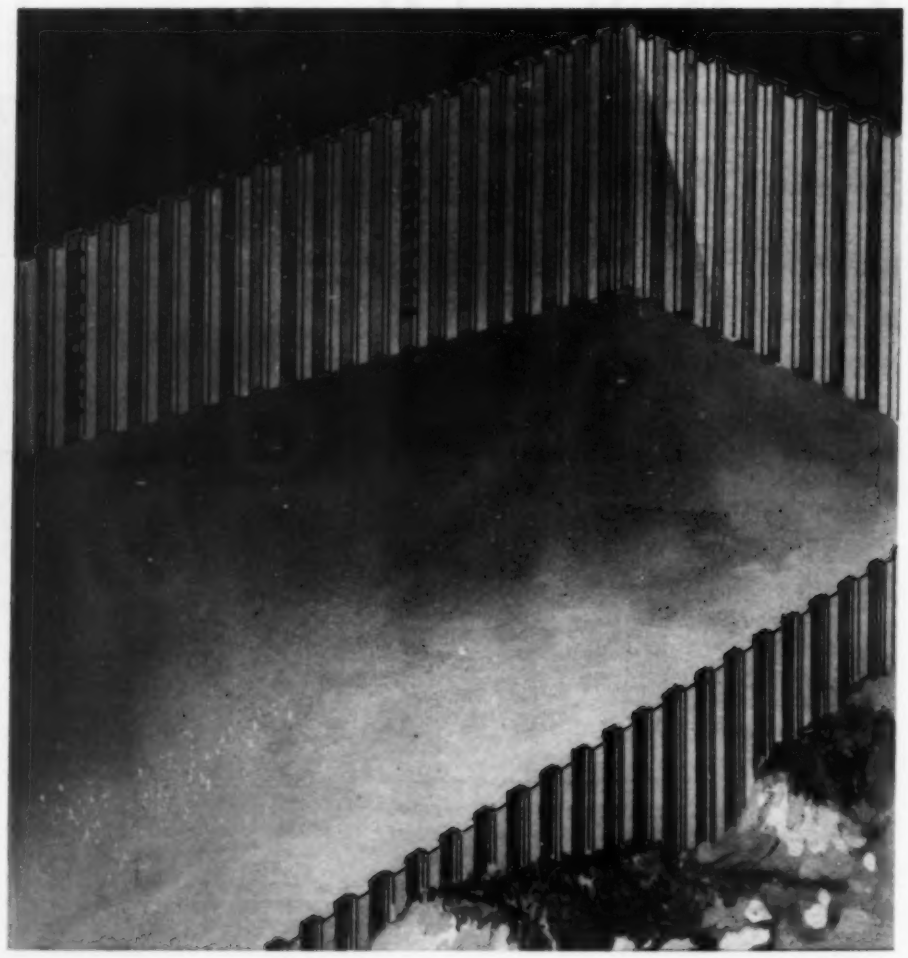
'Incor' now costs little more than ordinary Portland Cement—a fraction of resulting economies. 'Incor'* is made by the producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York, and is sold by other leading cement manufacturers.

* Reg. U. S. Pat. Off.

'INCOR' 24-Hour Cement



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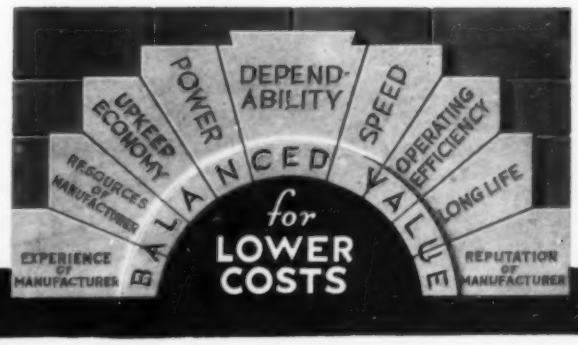
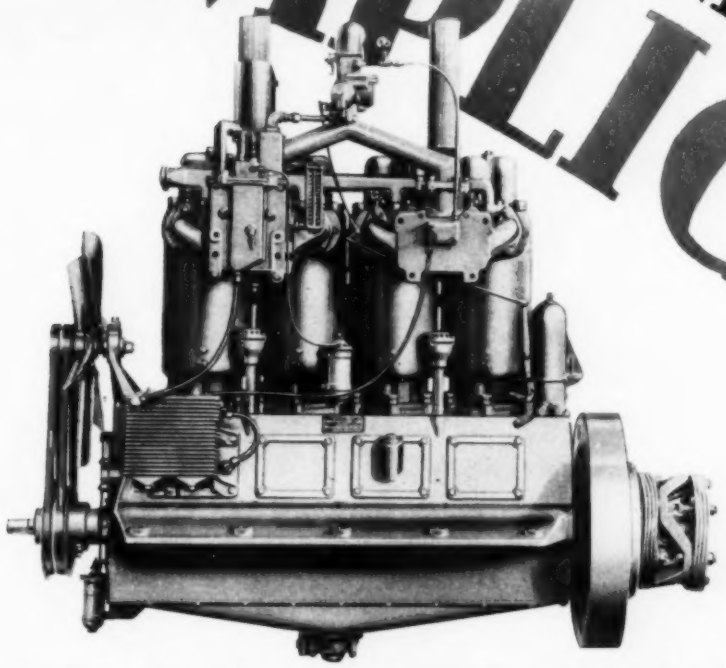
● When you buy a Bucyrus-Erie Diesel you get a unit that went through the experimental stage over ten years ago.



BUCYRUS-ERIE COMPANY, South Milwaukee, Wisconsin

See BUCYRUS ERIE *before you buy!*

AN OIL ENGINE WITH GASOLINE ENGINE SIMPLICITY



Here are all the engine advantages required to make *your* job a profitable one—simplicity of operation with low cost, dependable power!

There are no moving parts not found in a gasoline engine.

There are no injectors or fuel pumps.

It is readily understood by any gasoline engine man.

There are no destructive high pressures.

—And it burns ordinary furnace oil!

You will want to know what it will save on your job. You will want to know who is using it. You will want to know about its other advantages. Write for details.

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The world's largest exclusive builders of gasoline, oil and electric powered shovels, cranes and draglines

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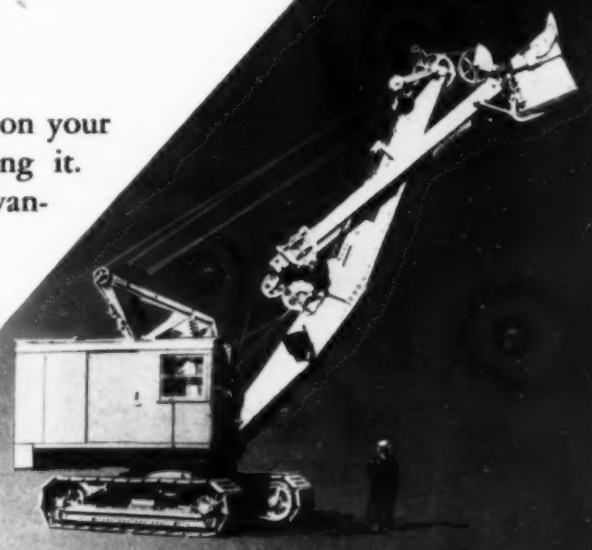

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FRANK HAAS

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This concreting system is mounted on the traveler. A skip-hoist pours concrete directly into a receiving hopper which feeds a concreting gun. This gun reaches all portions of the form through doors which are provided.

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These features and variations thereof to accommodate particular conditions prevailing on each individual job have proved Blaw-Knox Steel forms most successful on many railroad and water tunnels and earned the hearty approval of engineers and contractors everywhere. Not only was the construction time reduced but additional safety and reductions in cost were obtained.

Blaw-Knox has been designing and building Steel Forms for 28 years. Here is an accumulation of experience which is of inestimable value to any contractor, on any kind of a large or small concreting job.

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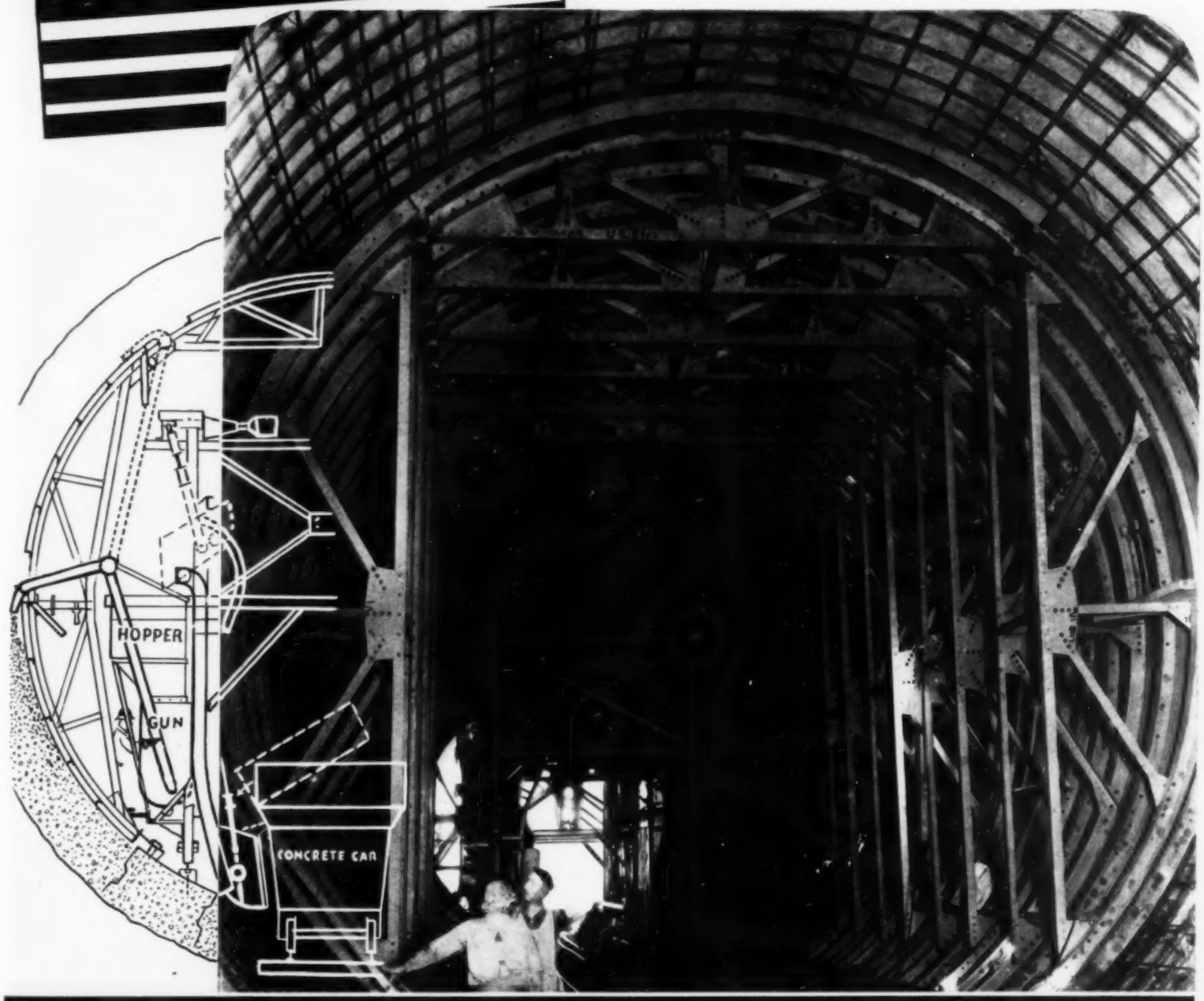

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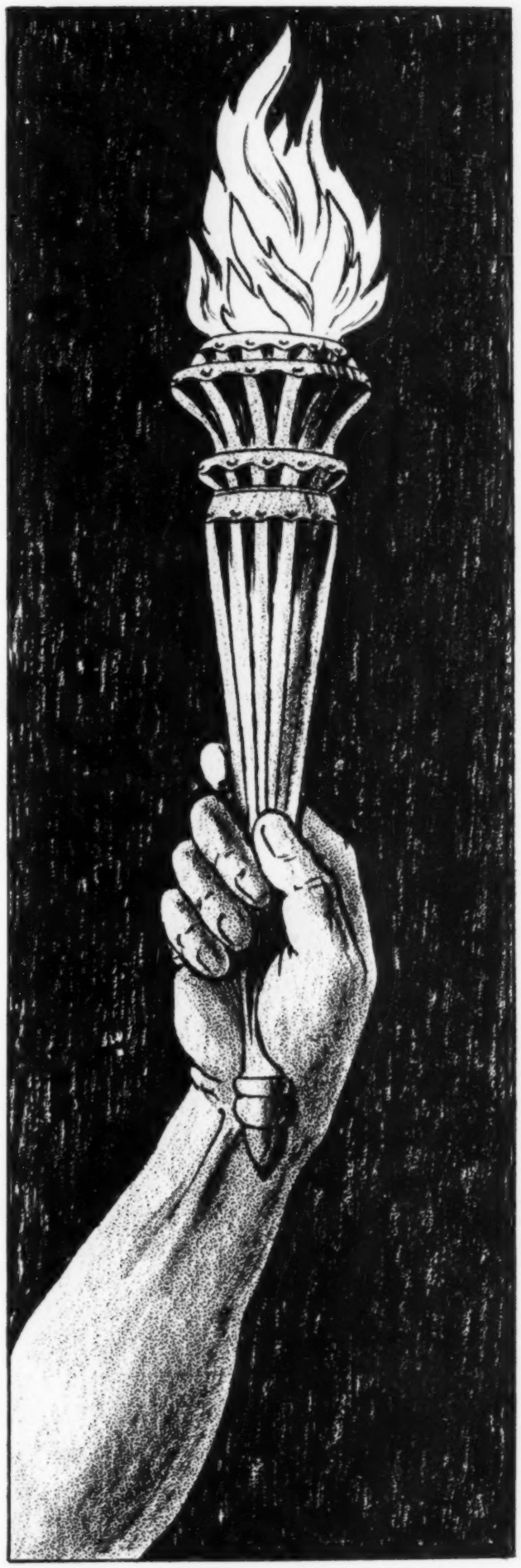

Just as construction has always gone forward to new and greater accomplishments so has "AMERICAN" Hoisting Equipment forged ahead in its service ability. As bigger things were done "AMERICAN" Hoisting Equipment was always equal to the occasion because Quality Engineering prepared it for dependable performance. It has earned the confidence of many and will increase its friends in tomorrow's service.

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"Our fuel saving is $4 to $5 per 8-hour day with the 'Caterpillar' Diesel"

• • says the Chairman of a Kansas County Board of Commissioners, whose "Caterpillar" Diesel Fifty Tractor pulls a 12-foot grader on 70c to 80c worth of 4½c fuel per day.

Near Audenried, Pennsylvania, the Dick Company is using "Caterpillar" Diesel Seventy-Fives to strip coal efficiently.

Near Seattle, this "Caterpillar" Diesel Fifty builds trails in clay soil, operating on 13½ to 14 gallons of low-price Diesel fuel per 8-hour shift.

The fuel economy of the "Caterpillar" Diesel makes power dollars do more work—gives public bodies more miles of road for fewer taxpayers' dollars—gives contractors the advantage of lower costs, bigger spread between expense and income. For the "Caterpillar" has added simplicity and a uniform high standard of performance. Get the complete story. Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

In Mexico, this "Caterpillar" Diesel Fifty Tractor, pulls a "Caterpillar" Grader on the Puebla to Oaxaca highway.

GETTING THE DIRT *out*

when even GETTING IN IS TOUGH

● If all the earth that must be moved lay beside a broad, smooth highway Western Crawler Dump Wagons couldn't be sold at a nickel apiece, and the contractor would perhaps get the job at a nickel a yard. But on broken ground, the problem is to save every nickel possible, and come out with the dirt—and a profit. That's the Western Crawler Dump Wagon's job. In its unique spring wind-up alone, which does away with the man formerly needed to dump and wind-up, it saves labor and time to the tune of many nickels.

● Often used with these Crawler Wagons, the Western Elevating Grader, or the Austin Contractor's Special Elevating Grader, make an ideal combination for grading and hauling with the greatest economy. Send the coupon for details.

The Shouldering Attachment for the No. 6 Elevating Grader, illustrated above, is accurate and a big saver of time, labor and money.

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Sold and serviced in this territory by Austin-Western

Let's get one Job DONE!

Going to work *only* every other day? Not if you can help it! Profits will depend on skillful planning—making the best use of men and equipment—sticking at the job until it's DONE.

Doing any blasting? Contractors are finding it profitable in many cases to keep on drilling until all the holes are ready; then shoot as one giant blast. Where such a shot is practicable it offers certain savings: (1) You can keep the drills, compressors, lines, tractors and other equipment on the ground until all the holes are finished, instead of being forced to move this equipment back and forth for a number of small shots. (2) You can use the blast to shoot a large part of the material out of the right of way, if the layout permits this. (3) You'll get more work out of your explosives, and (4) better fragmentation, which means easier removal.

Cordeau-Bickford is an insensitive detonating fuse. One detonator is used to set off the Cordeau, which in turn detonates every cartridge in every hole in the hook-up. It has brought a new technique in blasting—it has made the giant blast possible and profitable—*and it is now bringing to smaller hook-ups many appreciable advantages and savings.*

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Ensign-Bickford Safety Fuse is available in a number of standardized brands, each carefully made for a particular set of conditions. The use of Safety Fuse simplifies blasting technique.

Also—there are a number of Ensign-Bickford lighters, inexpensive—and positive in action.

CORDEAU
DETONATING FUSE
BICKFORD

This book explains Cordeau and shows how to use it. A copy will be sent free —to executives.

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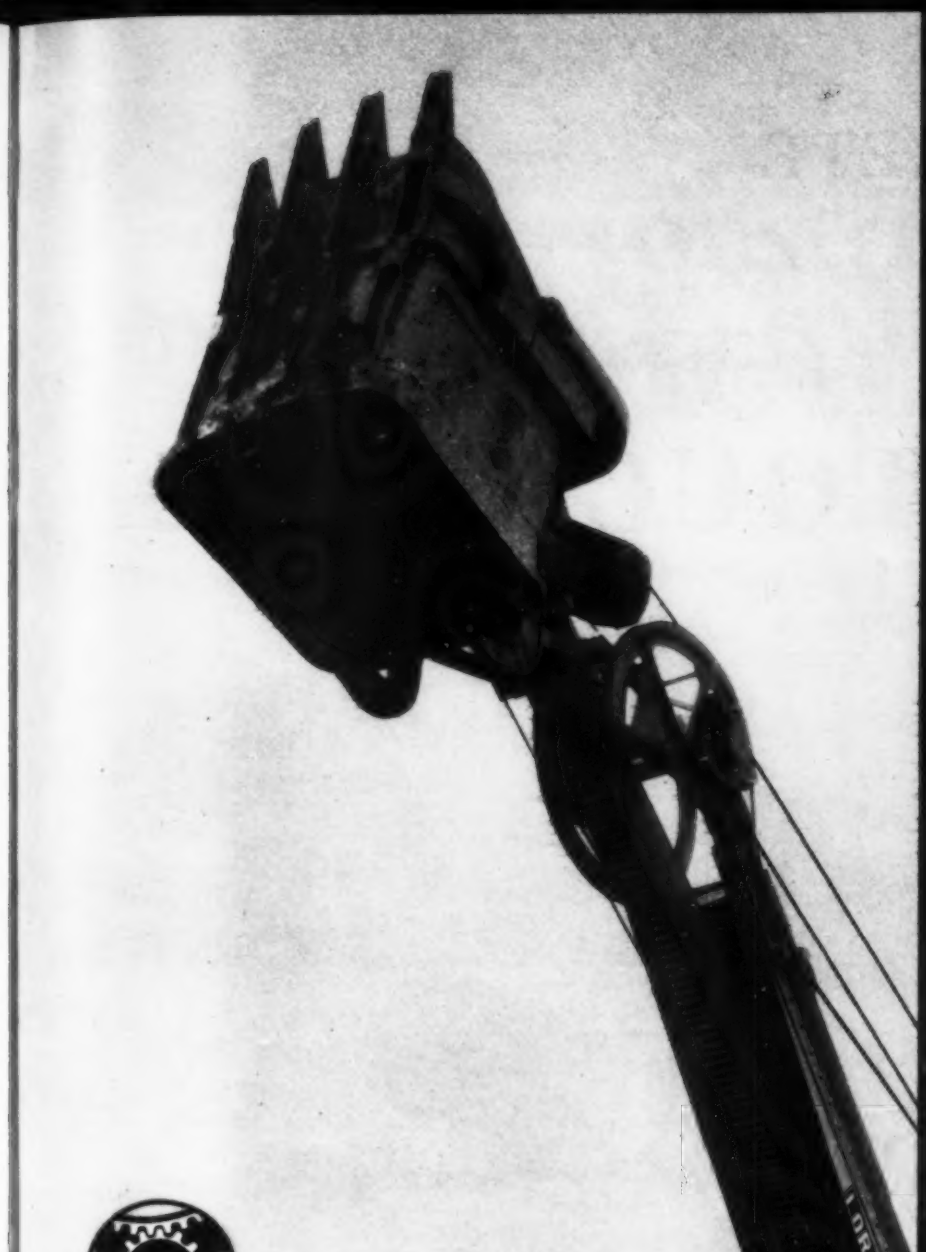
THE ENSIGN-BICKFORD CO., SIMSBURY, CONN.



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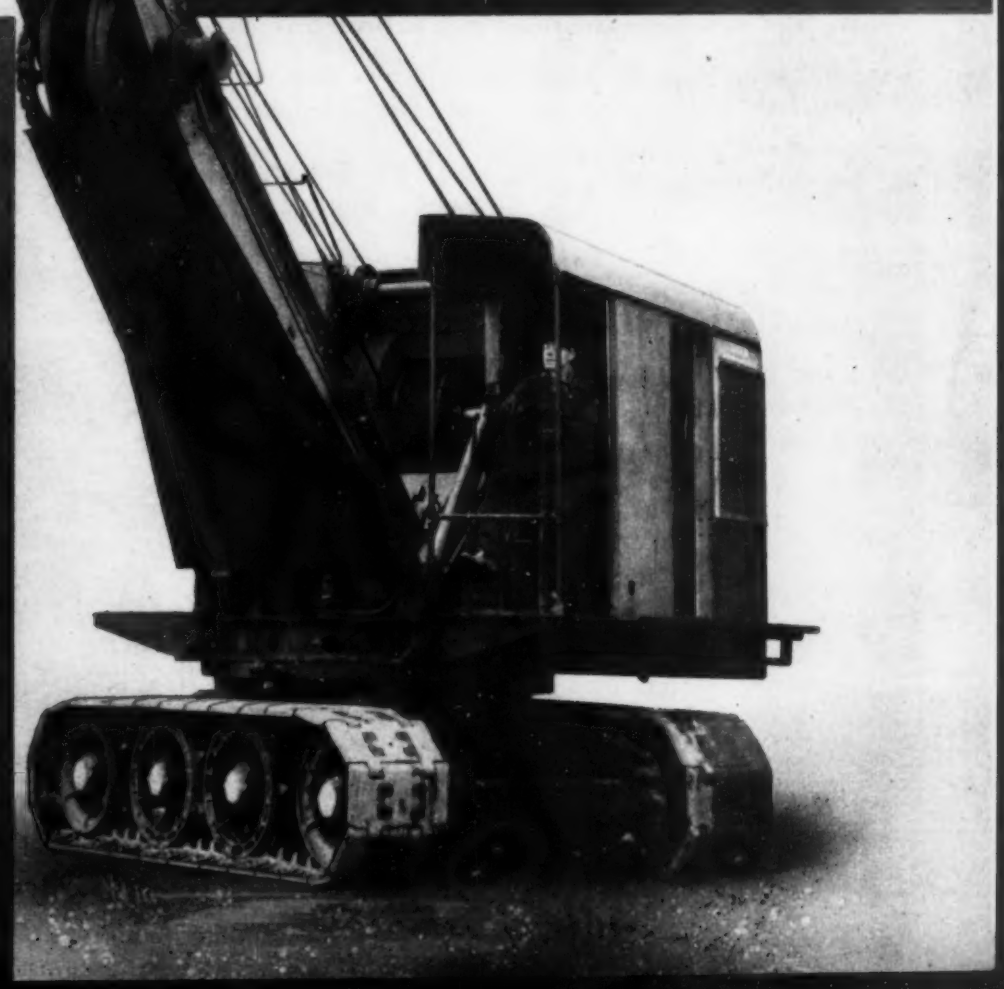

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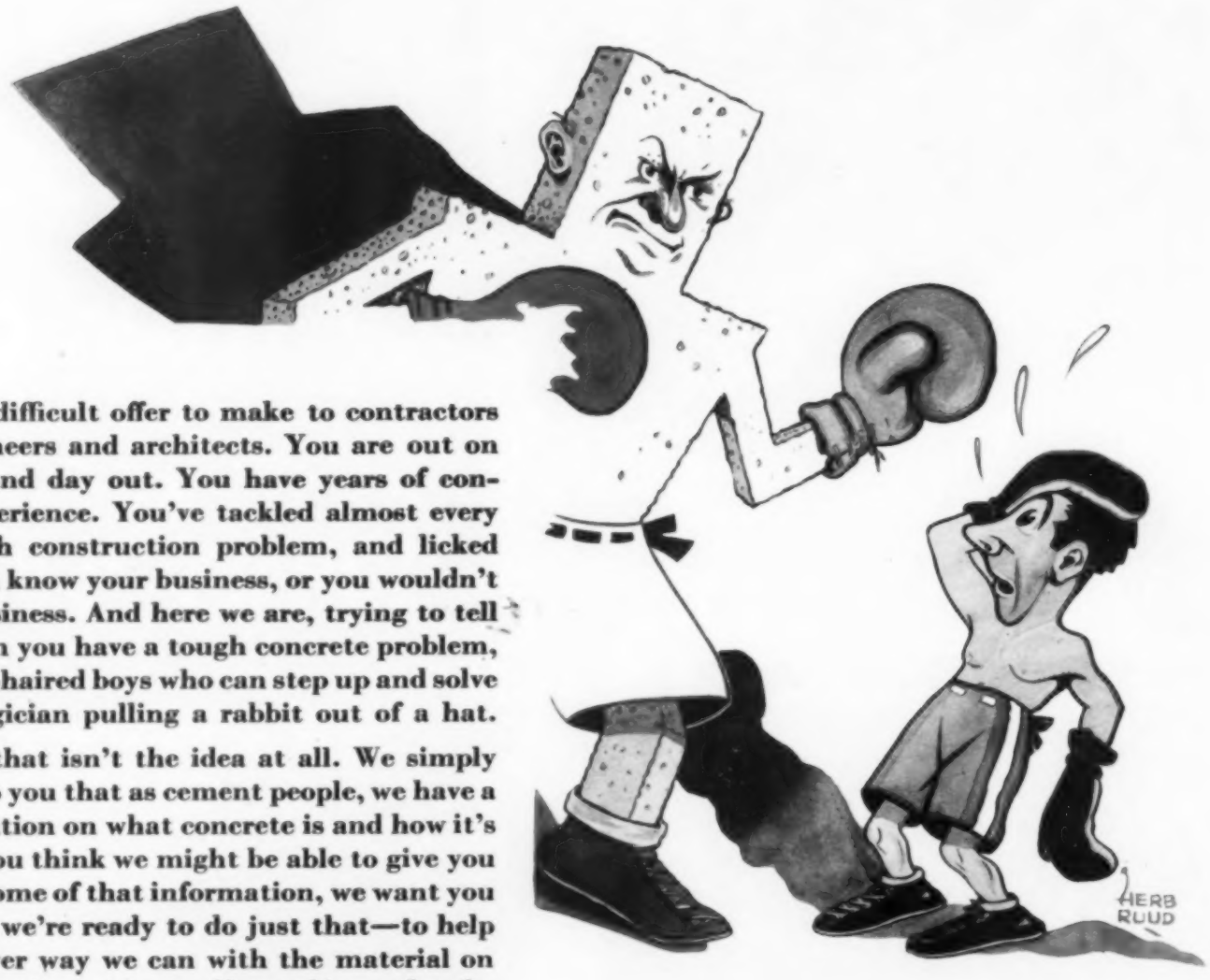
WHEN IT'S CONCRETE
And You're Up Against a TOUGH ONE



THIS is a difficult offer to make to contractors and engineers and architects. You are out on jobs day in and day out. You have years of construction experience. You've tackled almost every kind of tough construction problem, and licked them all. You know your business, or you wouldn't still be in business. And here we are, trying to tell you that when you have a tough concrete problem, we're the fair-haired boys who can step up and solve it, like a magician pulling a rabbit out of a hat.

Of course, that isn't the idea at all. We simply want to say to you that as cement people, we have a lot of information on what concrete is and how it's used. When you think we might be able to give you a hand with some of that information, we want you to know that we're ready to do just that—to help out in whatever way we can with the material on concrete that we've got in our files and in our heads.

Next time you think some of that material might help answer a tough concrete problem, write or phone our nearest office (see check-list at right), and let us puzzle it out with you. No charge, of course, because as we've said before, that kind of service is part of every barrel of Universal Atlas cement that's sold.

Check-List on Concrete Information

Prompt advice on concrete problems from these Universal Atlas Cement Co. offices:

NEW YORK—Chrysler Bldg. **BIRMINGHAM—Brown-Marx Building**
PITTSBURGH—Frick Bldg. **KANSAS CITY—911 Walnut Street**
WACO—425 Austin Avenue **MINNEAPOLIS—405 Second Ave., South**
CHICAGO—208 South LaSalle Street

UNIVERSAL ATLAS CEMENT CO.

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166

Construction Methods

ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc.

Volume 16—Number 5—New York, May, 1934

EXCELLENT NATURAL LIGHTING *(left)* and drainage of rain water is insured by utilizing the principle of saw-tooth roof design in the form of thin reinforced concrete arches, connoidal in form, spanning 57.4-ft. bays into which Metropolitan subway maintenance and repair shops are divided by lines of columns.

French Shops Roofed With

Thin Connoidal Concrete Arches

PROVIDING ADVANTAGES of natural lighting and rainwater drainage generally associated with saw-tooth construction, but radically different in form from that type of design, roofing of thin concrete arches, connoidal in shape, has been applied to shops recently built at Fontenay-sous-Bois for maintaining and repairing the rolling stock of the Metropolitan subway system of Paris. As constructed by the Société des Enterprises Limousin, the main building covers a ground area of 153,007 sq.ft. and is divided into two sections, one the maintenance shop, 42,179 sq.ft. in plan, and the other the repair shop, 110,828 sq.ft. in plan.

Each shop is divided into bays 57.4 ft. wide between lines of columns which support a series of thin connoidal arches of reinforced concrete forming the roof, as illustrated in the accompanying photographs. With a span of 57.4 ft., each arch is 26.2 ft. long. The curved concrete shell has a thickness of only 2 in. and is stiffened by three ribs, 14x6 in. in section, spaced 13.1 ft. apart. Each arch is supported by six columns, the two on each end carrying jointly the front and rear of succeeding arch units. The thrust of the arch is taken up by three tierod members joining the lower extremities of the three curved ribs of each section. The central tie consists of six ½-in. steel rods while the end ties, taking the thrust of two successive arch sections, is made up of ten rods of the same diameter. At the one-third points in the arch span the tie members are supported by vertical suspender rods.

In each arch section steel reinforcement consists of 0.22-in. rods spaced about 8 in. on centers transversely and about 4 in. on centers longitudinally.

As reported in *Le Génie Civil* by Marcel Fauconnier, works director for the Metropolitan company, load tests of the thin arches indicated their strength to be more than adequate. While the factor of safety against rupture by a combination of wind and snow loads is extremely high it is not possible, from the point of view of practical construction procedure, to decrease the 2-in. thick arch shell.

As indicated in the illustration below concrete for the thin arch shells was delivered to the forms by inclined chutes and spaded to place by hand.

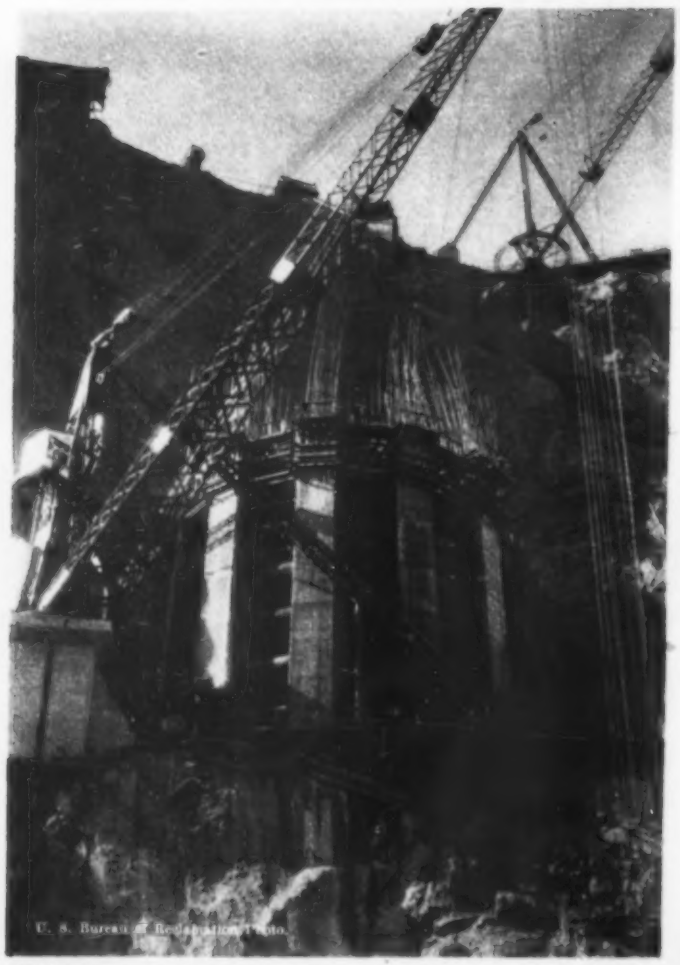
INCLINED CHUTE delivers concrete for thin arches into forms, where it is spread by hand.

This Month's

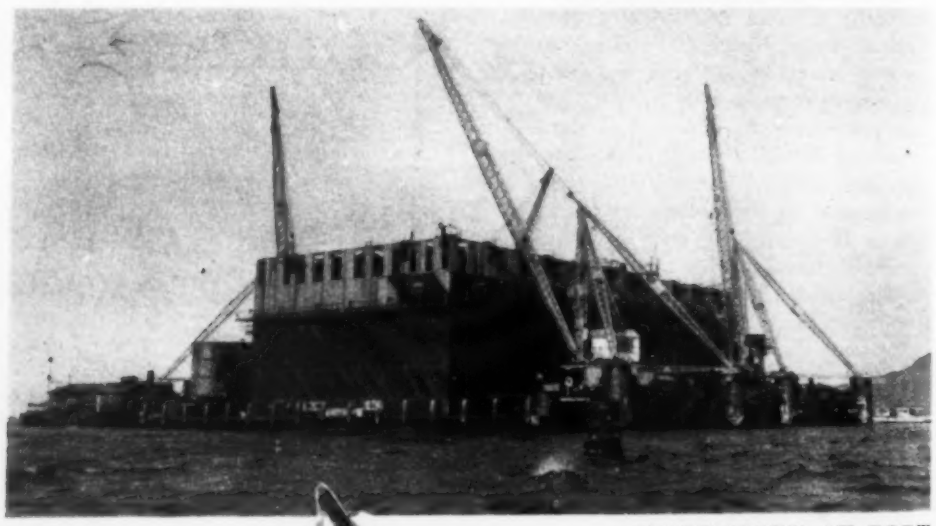
"NEWS REEL"

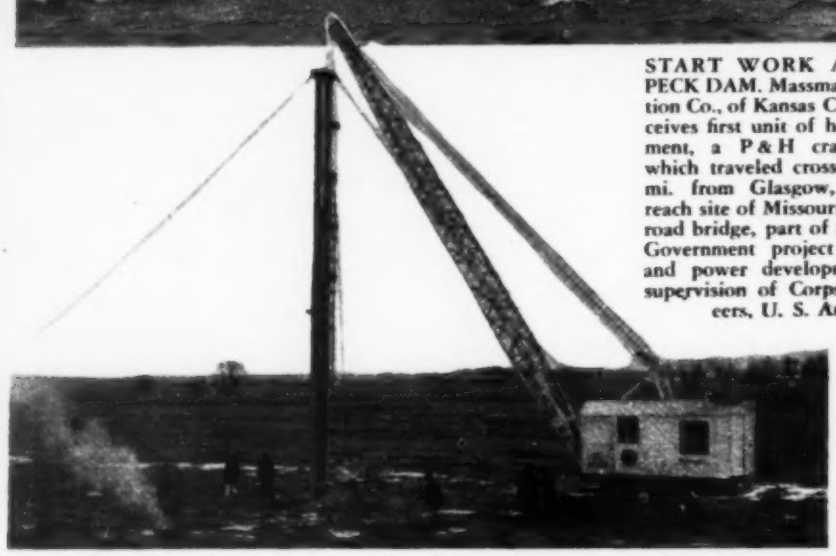
SPEED DRILLING CONTEST *(left)* **for workers on Colorado River Aqueduct tunnels is staged at Indio, Calif., March 17 by Metropolitan Water District of Southern California. The winners** *(above)* **Bob Banovich and Charlie Carlson, of Wide Canyon Camp, operating Gardner-Denver self-feed drifter, received $500 prize for completing 5½-ft. hole in granite block in 5 min. 38 sec.; time included mounting drill, making connections, sinking hole with two changes of steel, and dismounting equipment. Fifty-two teams competed.**

HUGE CAISSON, 100x200 ft. in plan, has been floated to place and is being sunk to depth of 180 ft. for Pier 4 constituting central anchorage of San Francisco-Oakland Bay bridge. Flotation is controlled by displacing water in nest of domed vertical dredging wells by compressed air. Contractor, Transbay Construction Co.

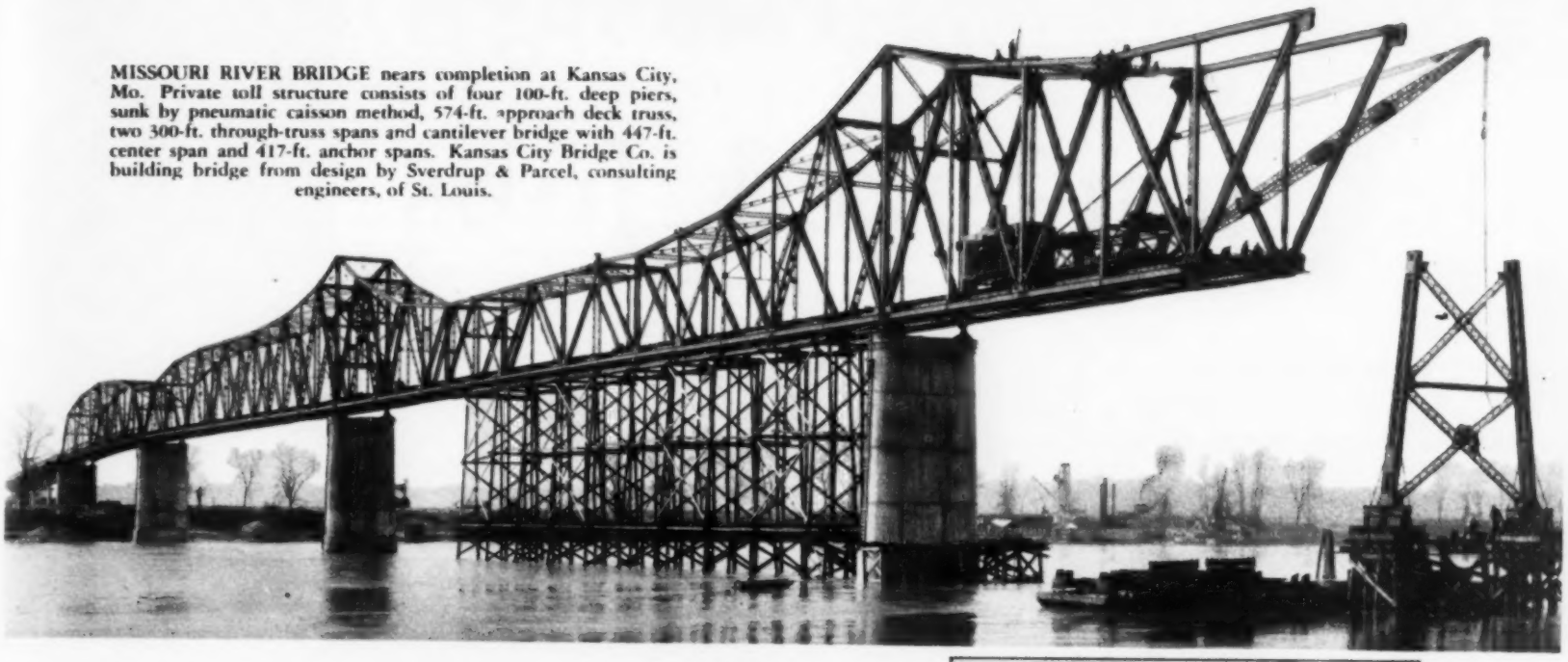


INTAKE TOWER for Boulder Dam rises on Nevada side of Colorado River canyon. Six Companies Inc., contractor, uses stiff-leg derricks mounted on each side of canyon to deliver concrete to the four 384-ft. high circular shafts forming the towers.





START WORK AT FORT PECK DAM. Massman Construction Co., of Kansas City, Mo., receives first unit of heavy equipment, a P & H crawler crane which traveled cross-country 30 mi. from Glasgow, Mont., to reach site of Missouri River railroad bridge, part of $60,000,000 Government project for water and power development under supervision of Corps of Engineers, U. S. Army.



MISSOURI RIVER BRIDGE nears completion at Kansas City, Mo. Private toll structure consists of four 100-ft. deep piers, sunk by pneumatic caisson method, 574-ft. approach deck truss, two 300-ft. through-truss spans and cantilever bridge with 447-ft. center span and 417-ft. anchor spans. Kansas City Bridge Co. is building bridge from design by Sverdrup & Parcel, consulting engineers, of St. Louis.

CONSTRUCTION CODE AUTHORITY

Certificate of Registration for Construction Work or Services

ISSUED THROUGH THE DIVISIONAL CODE AUTHORITY FOR

GENERAL CONTRACTORS

№ 1 1934

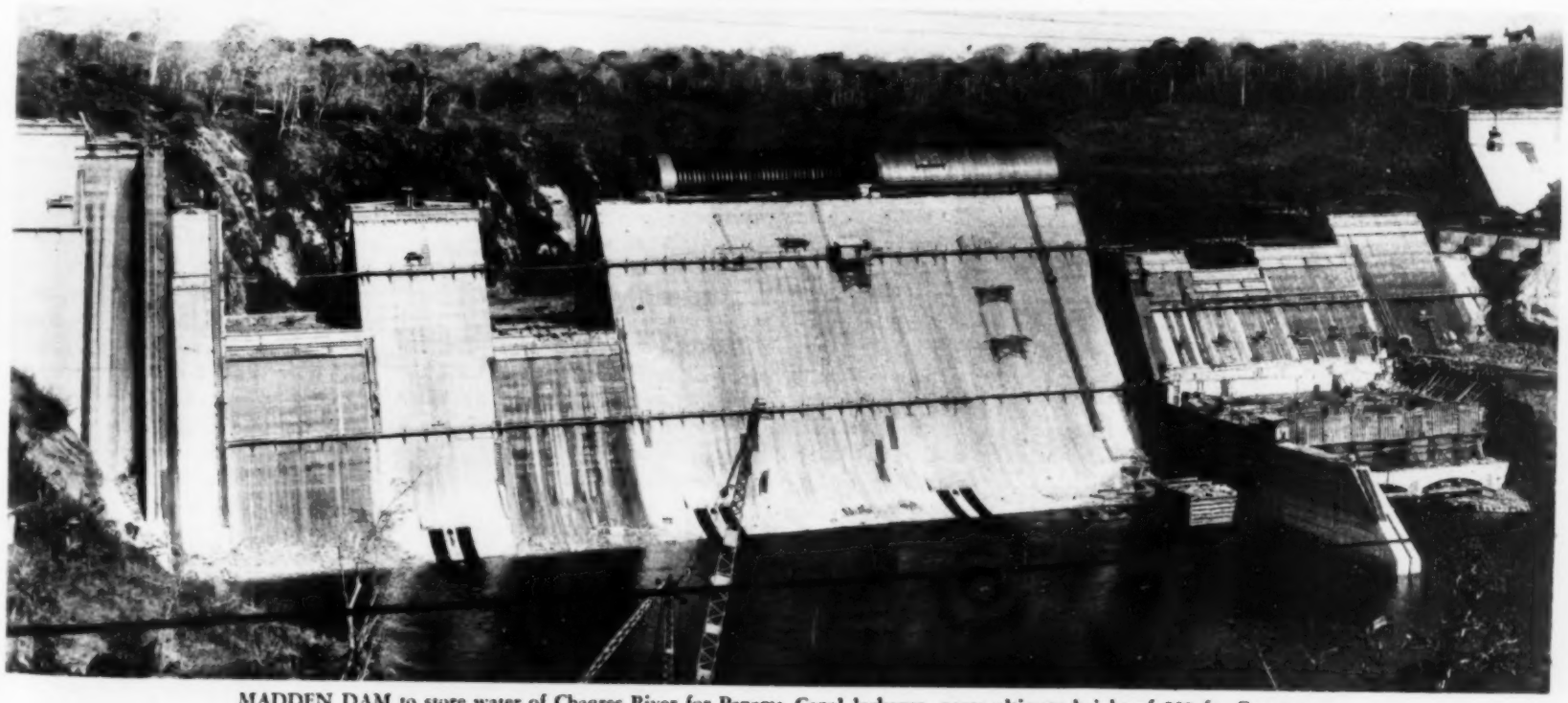
ISSUED TO W. E. WOOD COMPANY

PROJECT 2ND STORY ADDITION, POWER HOUSE, MARYGROVE COLLEGE

LOCATION DETROIT, MICHIGAN

Date APRIL 5, 1934 J. W. Follin

FIRST CONTRACT REGISTERED under NRA. Construction Code Authority, on April 5, issues certificate to W. E. Wood Co., of Detroit for 2-story addition to power house. *(Left to right, seated)* Stephen F. Voorhees, chairman, Construction Code Authority; J. W. Follin, secretary; N. F. Helmers, president, Associated General Contractors of America. *(Standing)* E. J. Harding, secretary, and Louis W. Hickey, executive manager, General Contractors' Divisional Code Authority.



MADDEN DAM to store water of Chagres River for Panama Canal lockages, nears ultimate height of 220 ft. Concrete structure of 500,000 cu.yd., costing about $4,000,000, is 900 ft. long and includes 436-ft. spillway section at center, equipped with drum gates. With one cableway, the contractors, W. E. Callahan Construction Co. and Peterson, Shirley & Gunther, have placed 400,000 cu.yd. of concrete in ten months.—*Photo from R. M. CONNER, general superintendent.*

Planning and Planting

Medium-Sized Jobs

J. B. BURGHARDT

By J. B. BURGHARDT,
Formerly Construction Superintendent for J. R. Hampson & Co., Inc., Contractors, Pittsfield, Mass.

THERE IS NOT enough thought given to the relation between proper equipment, properly installed and used, and profit on a contract. True enough, on a job the size of Rockefeller Center, in New York, or Boulder dam, the equipment is given proper consideration, for in the last analysis on a large project it is equipment which answers the question "Can we make a profit at this price?".

If we agree that the importance of proper equipment holds true on a large project, why are the everyday run of medium-sized and small jobs not given some measure of consideration from that angle? Isn't it true, after the quantities are taken off and the estimate is listed ready for pricing out, that an estimator is prone to say "Let me see the cost sheets on such-and-such a job; that was very much the same kind as this one." Then he goes to work pricing the estimate on that basis, never giving any thought to the fact that, since the other job was finished, new, labor-saving equipment may have been put on the market.

What is the result? If the estimator has forgotten enough items he is low enough to land the job, but if he has made up a careful, accurate estimate and has as competition a real live, up-to-the-minute outfit he is absurdly high. Then there takes place a wailing something like this: "They can't do it; it is impossible. So-and-so probably forgot the plastering, etc.". But did that same estimator ever go to the trouble of visiting the job while it was under construction by the outfit whose bid was low? Not usually. If he did he would without doubt have seen things to make him wonder. I'll be willing to wager that one of the first things he would notice would be a piece of equipment that he had never even thought of using.

Simple Plant Effective—Let me cite an example: In a certain Massachusetts city bids were asked for the construction of a large gymnasium, large enough to inclose an indoor baseball field, together with the usual basketball courts, swimming pool, locker and shower rooms. What does that mean? A large structure built to quite a height but with the baseball field on natural ground, meaning no appreciable amount of excavation but a large amount of concrete foundation spread all over the lot. In other words, while there was a large amount of concrete to pour, it was not concentrated in any one spot, nor easily reached with one set-up of plant.

CHURCH of granite ashlar backed by common brick. Long narrow shape of structure presented problems of construction discussed in accompanying article.

Some time after the job was awarded, the story of what had happened was told to the writer. The contracting firm was a wide-awake one and in going over the plans while making up the estimate the question of how to handle that concrete was brought up. What was the most efficient solution? They made an appointment with an equipment salesman——a real one, not simply a peddler. Various plans were suggested and all the pros and cons thrashed out, perhaps discarded at once, perhaps held in abeyance until all possible solutions could be studied in detail. The result was that through a suggestion by the salesman a plan was developed which was felt to be the best possible solution. What was more, it did not require much of any layout for new equipment — merely a "litter carrier" of large size such as is commonly used for the removal of manure from dairy barns. The carrier track was mounted on "A"-jacks of 2x4's, making the sections easily portable. The power for the cable was supplied by the drum mounted on the concrete mixer, a Jaeger 7L unit. Essentially the installation was a small-sized edition of a cableway.

This plan was so simple that no one had ever given it a thought, but it worked to perfection. The bid, based on this plan, was substantially lower because the contractor had gone to the trouble of working out a simple, inexpensive way of handling that concrete. The rest of the job was more or less routine. They were awarded the contract, and, best of all, they MADE MONEY ON IT.

Plant Layout for Church—Let me give you another illustration of what careful planning and cooperation will do. The structure I have in mind was built by the firm with which the writer was associated at the time as superintendent of construction. The job was a church built of granite ashlar backed with common brick. The ashlar was to approximate 6 in. in thickness. There was to be a 2-in. air space between the back of the ashlar and the face of the backup brickwork. Plastering was to be done directly on the brickwork, which was to be given a coating of Toch Bros'. R.I.W., sprayed on.

The biggest single problem was getting the stone, brick and mortar to the masons. Here is where careful planning is essential. The pilasters at each truss bearing extend nearly 2 ft. beyond the face of the wall. The church is long and very narrow (see plan), the west side being so close to the property line that any storage of material or location of equipment on that side was out of the question. Yet there was as much material going into the west side as into the east. The problem, then, was to get the material to the west side, especially after the structure rose 10 ft. from the ground. When you stop to consider that 600,000 brick and 22 carloads of ashlar were used, to say nothing of the sand, lime and cement in the mortar, it is clear that a great many tons of material had to be handled. Starting out on the supposition that it would be possible to get the material on to the staging with only one handling after it had been landed on the job, this is what took place:

The writer, with the stone mason, brick mason, carpenter foremen, and the above-mentioned equipment salesman, spent the better part of a day listening to each other's suggestions as to how to handle the material, chewing over this one and that one until in the opinion of all the proper solution had been arrived at. We dis-

cussed the matter of using a boom derrick and scale boxes, but that was discarded because the structure was so long and narrow and the walls so high. The question of elevators was considered. At first, the idea was to place an elevator at each end of the building; that had to be discarded because of the proximity of a high bank at the rear. It all boiled down to the fact that, due to the contour of the land and the position of the building, it was necessary to handle the material from the east side.

The Solution—We finally agreed to the following solution, illustrated in the accompanying sketch: A tubular steel elevator of three-wheelbarrow capacity was erected between axes 7 and 8 on the east side. The mortar mixer, in the location shown was easily accessible to the sand and lime trucks. The cement, as it was delivered to the job, was stored in piles under the tarpaulins near the mixer. The discharge spout was faced toward the elevator and a four-plank runway laid, pitching toward the elevator to facilitate the moving of the loaded barrows. The brick was dumped as near the elevator as possible. The granite, handled by the same trucking crew, was dumped near the elevator, but on the north side. A Sasgen boom-derrick was set up, as shown, to handle the unloading of the cast-stone trim.

For the outside staging, putlogs, 3x5 in. by 7 ft. were purchased to insure sufficient clearance beyond the pilasters for the use of wheelbarrows. A bridge was built from the elevator to the opposite (west) side of the building. The elevation of the bridge was kept at all times above the elevation of the walls to facilitate wheelbarrowing.

Since the general contractor had to furnish the staging for the lathing and plastering contractors, and since the backup brickwork had to be laid from the inside after the stone work was run up from five to seven courses, the inside staging was built two-pole and the inner poles kept far enough from the walls to allow the plasterers to work. Due to that fact it was necessary to build elbow outriggers to the staging to make it suitable for brickwork.

Special Problems—One or two special problems which we encountered may be of interest. At the top of each wall column, 22 ft. above the finished floor, it was necessary to erect cast-stone angels, weighing 1,800 lb. each. An ordinary timber dolly was used, on which a three-plank platform was built. The angels were landed on the dolly truck just off the elevator and pushed on to the elevator, raised to the proper level and pushed around into position on the interior staging, which was reinforced especially for this purpose. A 6x6 in. spruce stick with a single-drum, manually operated crab equipped with 5/16 in. ploughsteel wire rope reeved through a triple and double steel block was the means used to uplift and land the angels in position. The staging was placed about 10 in. below the top of the columns so that the angels were suspended in the air for only a short time.

The problem of handling the semicircular window heads in the nave section was solved by mounting a Sasgen derrick on a stake-body-type truck. The stones were landed as close to their final resting place as possible and hoisted from the ground into position by the derrick. The boom derrick was left on the truck and used to land ashlar on the staging, especially on the north end. It was also used to handle all the cast stone in front as high as it would reach.

Another matter which caused a deal of concern was the placing of the one-piece stone in the bell niche. This stone weighed about 1½ tons. It was handled, as shown in the accompanying sketch, by mounting a triple-geared floor crab on two 8x10 in. timbers, the ends of which were snubbed against the foundation to prevent sliding or tipping. At the top of the staging, which was especially reinforced, was placed a cathead equipped with a length of new ½-in. wire rope. Two men raised this stone into position from where it was swung into place and set by the mason. The chimney capstones which, of course, were not as heavy but were far too heavy to get up in any other way, were handled in a like manner. As soon as the rear of the building was finished, the rigging was moved to the front and the turret stones were handled by it.

The cast stone in the arches supporting the clerestory walls was set by two gangs, one using a homemade boom derrick mounted on a triangular shaped gig movable along the floor. This rig set the columns and the arch centers and was followed by a breast derrick which set the rest of the arch.

Maximum production was reached after we got above the top of the arches and until we reached a point at the top of the low roof where we again swung back into the ashlar facing. The writer vividly recalls the day that thirteen brickies, serviced by eight tenders and the "mortar man", used up 24,000 brick in one day. Of course, the wall was solid brick with no pilasters or other breaks in it. So much for the stone and brickwork equipment. Suffice it to say that on the whole job not over 15,000 brick saw a hod.

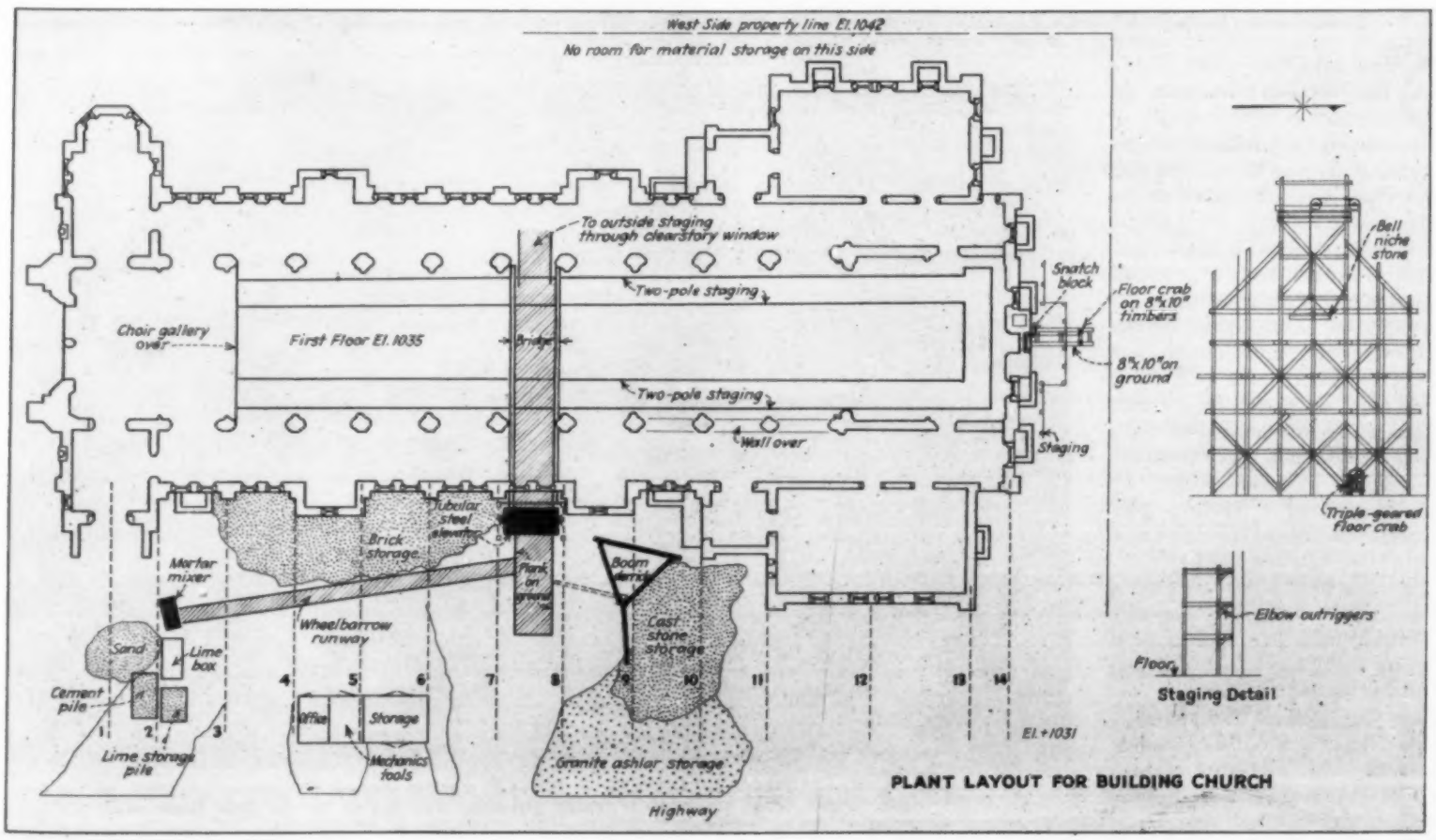
We used a Beaver woodworking machine with a rip and cut-off saw and jointer to do practically all the cutting for the blocking and framework in the trusses and the clerestory and low ceiling wood trim. We had a 10-in. saw and six portable electric hand-saws which were used to frame all the floor joists and roof rafters, as well as the cutting of all the 1¼-in. roof planking on the ground. The 10-in. saw which would handle 3-in. stock was used to make all the arch centers. All the (upper) roof rafters and boarding was sent up in the elevator.

Because the superstructure was not started until July 15 the job was equipped electrically. Winter weather in this region usually sees nights below zero and the wisdom of not using gasoline engines can readily be seen.

The foundation, except under the Baptistry and front steps, was installed by another contractor. Our outfit moved on to the job June 25, 1931; the opening exercises in the church were held the Sunday before Memorial Day, 1932. Completion in eleven months.

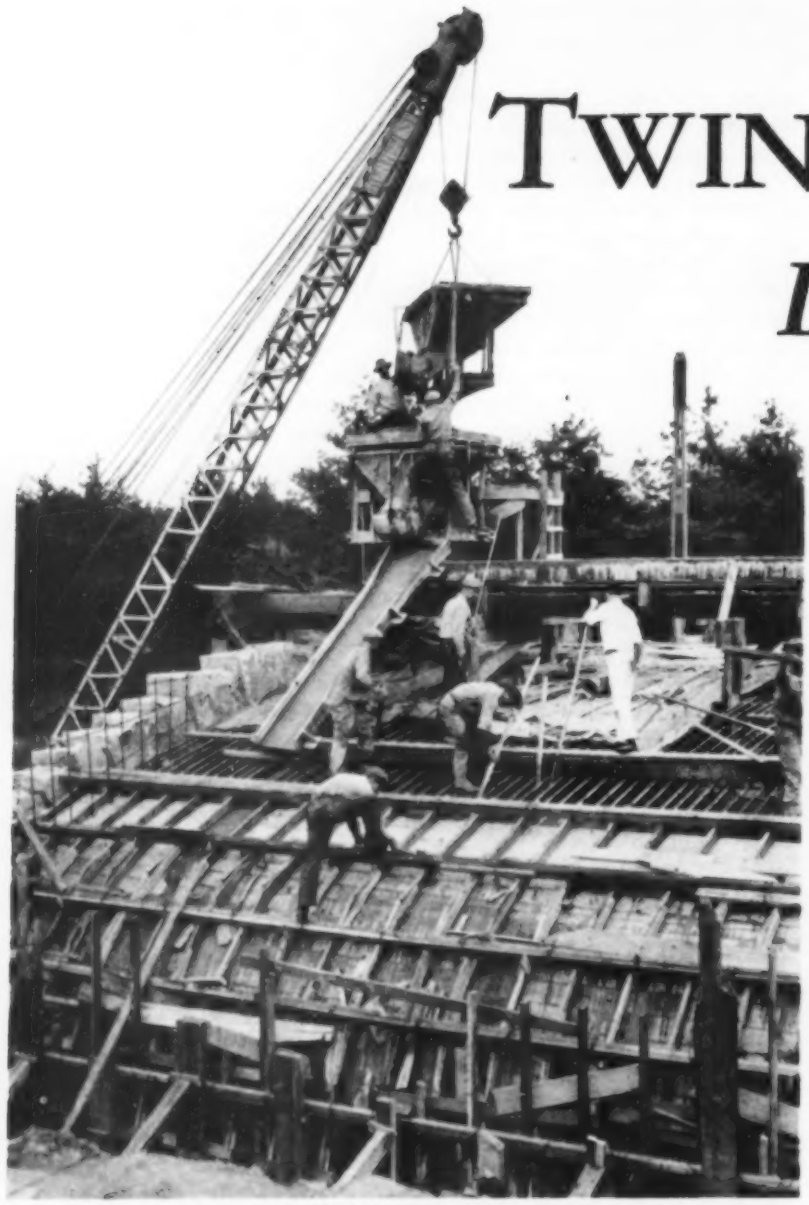
Of course, all the things that we ran into were not foreseen and discussed on the day that we settled on the proper equipment. But the basic scheme was followed out exactly in accordance with the plans worked up that day and the results were satisfactory.

I believe that it all goes to prove the worth of taking time enough to study every job from the equipment angle



PLANT LAYOUT FOR BUILDING CHURCH

Twin Mixing and *Deliver Concrete for*



RADIAL-GATE SIDE-DISCHARGE HOPPER from dismantled car serves as concrete bucket, delivering material to similar hopper mounted on flanged-wheel truck.

DUAL MIXING AND PLACING PLANTS concreted the monolithic superstructures of two reinforced, rigid-frame bridges which the P. T. Cox Contracting Co., of New York City, constructed on the Northern State Parkway, Long Island, for the New York State Department of Public Works. Each of the two plants consisted of a paving mixer and a crawler crane which hoisted buckets of mixed concrete either directly into the forms or into hopper cars, manually operated on narrow-gage tracks. The cars distributed concrete to those portions of the arches which could not be reached by the crane booms. By these methods the two plants completed one-day monolithic concrete placements of 386, 426, and 524 yd.

Description of Bridges—As part of its system of super-highways extending east from the Borough of Queens, New York City, into Long Island, the State Department of Public Works is constructing the Northern State Parkway through Nassau and Suffolk counties. In common with the other through routes of the system, this highway crosses no important intersecting roads at grade. The two rigid-frame bridges constructed by the P. T. Cox Contracting Co. are grade-separation structures situated within a few hundred yards of each other. One bridge carries the Northern State Parkway across the Jericho Turnpike, and the second structure carries Hillside Ave. over the parkway. The parkway is being built 44 ft. wide, with two 10 ft. inner lanes and two 12 ft. outer lanes, in accordance with the department's standard design for four-lane parkway pavement.

Each of the two bridges is an elliptic arch built on a skew and faced with stone. The longer structure is at the parkway crossing over the Jericho Turnpike, where a 90-ft. arch span, with a square width across the bridge of 56 ft., face to face, was constructed on a 17-deg. skew. Clearances under this arch are about 18 ft. at the crown and about 14 ft. at the edge of a future 60-ft. pavement. The present width of the turnpike pavement is 40 ft.

As designed by the State Department of Public Works, Albany, N. Y., the bridge has footings 17 ft. wide resting on sand and gravel. Sloped bottoms on these footings reduce the thickness from 7 ft. at the inner edge to 2½ ft. at the outer edge. The rigid-frame arch, 4½-ft. thick at the footing, has a crown thickness of 2 ft. and a maximum thickness of about 6½ ft. at the haunch. A total of 156,000 lb. of reinforcing steel was incorporated in the arch and footings. The largest reinforcing bars were 1⅛ in. square. Reinforcement was closely spaced in the arch, longitudinal bars being placed on 5-in. centers in both the top and bottom.

A shorter arch span, 60 ft. in length, carries Hillside Ave. across the parkway. This structure intersects the parkway on a skew of 9 deg. 37 min. and has a square width between faces of 77½ ft. The design, which was executed by the Long Island State Park Commission, Babylon, L. I., differs from that of the bridge across Jericho Turnpike in using flat-bottom spread footings 7 ft. wide resting on a sand and gravel foundation. Thickness of the arch is 2½ ft. at the footing, 3 ft. 8 in. at the haunch, and 1¾ ft. at the crown. Total steel requirements amounted to 105,000 lb.; the longitudinal arch steel was distributed on 6-in. centers.

RIGID-FRAME REINFORCED-CONCRETE BRIDGE requires continuous concrete placement of 524 cu.yd. in arch forms supported by timber falsework. This bridge has cut stone fascia ring.

PLACING PLANTS
Rigid-Frame Bridges

Concrete Requirements—Two classes of concrete were used in the bridges. For the arches, the specifications required a first-class structural concrete of 1:2:3½ proportions. A second-class concrete of 1:2½:5 proportions was called for in footings, spandrel walls and wing walls.

To reduce the volume of concrete which had to be placed continuously in the Jericho Turnpike arch, requiring a total of 812 yd., the engineers divided the structure into two units by a longitudinal construction joint. The joint was placed about 1½ ft. off center to avoid coinciding with a splice in the reinforcing steel. This construction provided two monolithic units of 386 yd. and 426 yd. In addition to this concrete in the arch, the footings called for 142 yd. each, and the wing and spandrel walls required a total of 842 yd.

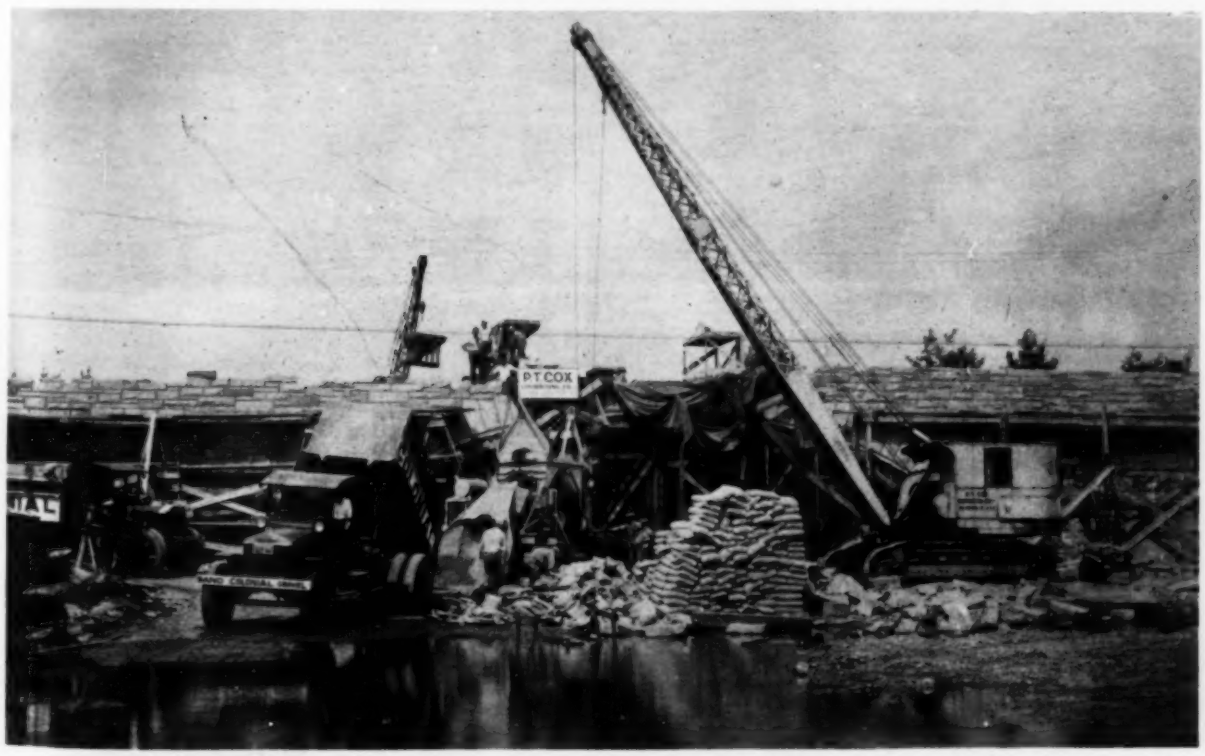
First-class concrete in the arch at Hillside Ave. aggregated 524 yd. This quantity could be placed continuously without the necessity of dividing the structure into smaller units. Each of the footings called for 55 yd. of second-class concrete, and the wing and spandrel walls required 720 yd.

Concrete Plant—All concrete for the two bridges was mixed and hoisted by two similar plants, each of which was equipped with a Foote 27-E paver. Concrete from the mixers was hoisted by an Orton gasoline crawler crane with a 45-ft. boom or by a Northwest gasoline crawler crane with a 40-ft. boom. One unit handled the concrete in a Blaw-Knox 1-yd. roller-gate bucket, and the other hoisted the batches in a hopper removed from a Koppel radial-gate, side-discharge car. Much of the concrete was placed directly by these buckets, and the rest was distributed by Koppel cars on narrow-gage tracks.

When concreting a longitudinal monolithic unit of the Jericho Turnpike arch, the two plants worked side by side and placed most of the concrete with the buckets. Near the crown of the arch, it was necessary to distribute concrete with the side-discharge hopper cars running on tracks laid across the bridge.

A different set-up was necessary at the Hillside Ave. bridge, where it was impossible for the cranes to place concrete across the 77½-ft. width of the arch. The contractor located the two plants on opposite sides of the bridge

CRANE AND BOTTOM-DUMP BUCKET of second concreting plant deliver mixed concrete from paver to hopper car on narrow-gage track.



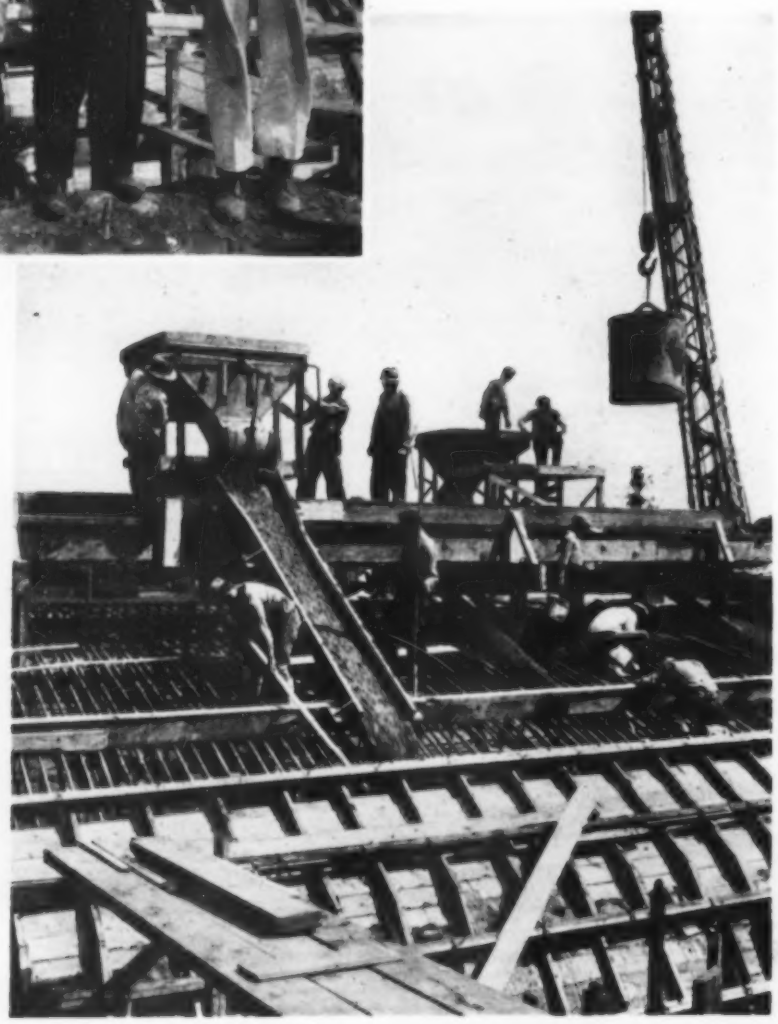
PAVING MIXERS AND CRANES operating on two sides of rigid frame bridge produce and hoist concrete for monolithic arch construction, finished with granite facing.

and transferred all concrete from the buckets into hopper cars operating on tracks laid parallel with the axis of the arch.

Falsework and Traffic Safety—Traffic had to be maintained on the Jericho Turnpike during the construction of the arch, and two 4-ft. lanes through the falsework were provided for this purpose. To simplify falsework construction, the timber bents of the temporary structure were lined up parallel with the center line of the turnpike. Outside the two traffic lanes, bents of 8x8-in. timbers were arranged with posts about 6 ft. apart in both directions. At the two roadways, the bents were constructed of 10x10-in. timbers, and the traffic lanes were spanned by 15-in. I-beams. Lagging of 2x4-in. lumber was laid transversely on longitudinal ribs (2x12-in. pieces) spaced 24 in. at the crown and 16 in. at the haunches. The lagging was covered with a lining of four-ply plywood.

To protect fast-moving traffic on the four-lane turnpike from danger of accidents at the two-lane passage through the falsework, the contractor erected

H. B. FOOTE, *(left)*, superintendent for P. T. Cox Contracting Co., and W. K. Koch, resident engineer for New York State Department of Public Works on construction of rigid-frame concrete bridges.



HOPPER CARS on narrow-gage tracks distribute concrete across arch, discharging loads through chutes into wood forms.

warning bridges across the highway at a distance of several hundred feet on both sides of the construction work and brilliantly illuminated the warning bridges and the falsework at night with batteries of floodlights. This care in protecting the traveling public was rewarded by entire freedom from accidents during the course of construction.

Neither of the intersecting roads had to be kept open to traffic at the Hillside Ave. bridge, where the falsework from Jericho Turnpike was used for the second time. The intrados design for this arch called for four longitudinal ribs protruding 2 in. below the inner surface. Falsework ribs and supporting posts accordingly were installed parallel with the center line of the bridge. The intrados concrete was given a rubbed finish, in contrast with a tooled finish on the surface of the intrados at the Jericho Turnpike bridge.

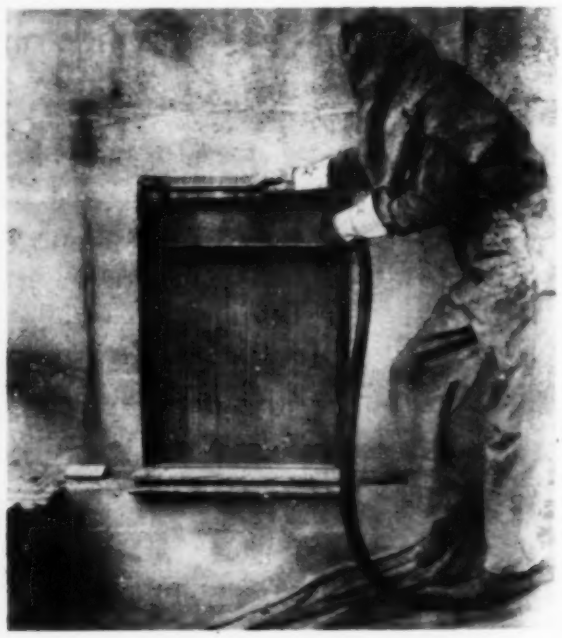
Stone Facing—Both bridges were faced with granite, the blocks of which were cut in such a way as to vary their color. The specifications called for 70 per cent of "rock face," or ordinary gray granite; 20 per cent of "seam face," or buff-colored stone; and 10 per cent of "split face." The contrasting coloring of the stone gives a pleasing variety to the facing of the bridges. Total stonework at the two bridges amounted to 368 cu. yd. of quarry stone and 100 cu.yd. of cut dimension stone. The Jericho Turnpike bridge has a concrete fascia ring, but the arch at Hillside Ave. is ringed with cut stones.

Tooling Concrete—To tool, or corrugate slightly, the surface of the intrados of the Jericho Turnpike arch, a sand blasting machine was employed to direct a stream of dry sand under pressure through a screen of closely spaced parallel No. 11 gage wires, held in a frame of light steel angles with inside dimensions of 3x2 ft. A smaller rectangular guide frame, which was moved from one end of the larger frame to the other as the tooling progressed, aided the operator in performing uniform tooling.

Supervision—For the State Department of Public Works J. J. Darcy, district engineer, Babylon, L. I., and J. Gurin, district bridge engineer, were in general charge of the work, which was supervised directly by W. K. Koch, park engineer, resident on the project; A. D. Greenman, supervising engineer, had charge of 80,000 yd. of sand-gravel fill in the bridge approaches. For the P. T. Cox Contracting Co., H. B. Foote, superintendent, directed construction.

WARNING BRIDGES across busy turnpike approaching new rigid-frame grade-separation structure eliminate highway accidents. Floodlights illuminate warning bridges at night.

SAND-BLASTING EQUIPMENT supplies stream of fine, silica sand under pressure through hose to operator holding nozzle in background.



TO TOOL SURFACE of rigid-frame concrete arch, contractor uses screen of parallel wires and sand-blasting apparatus.

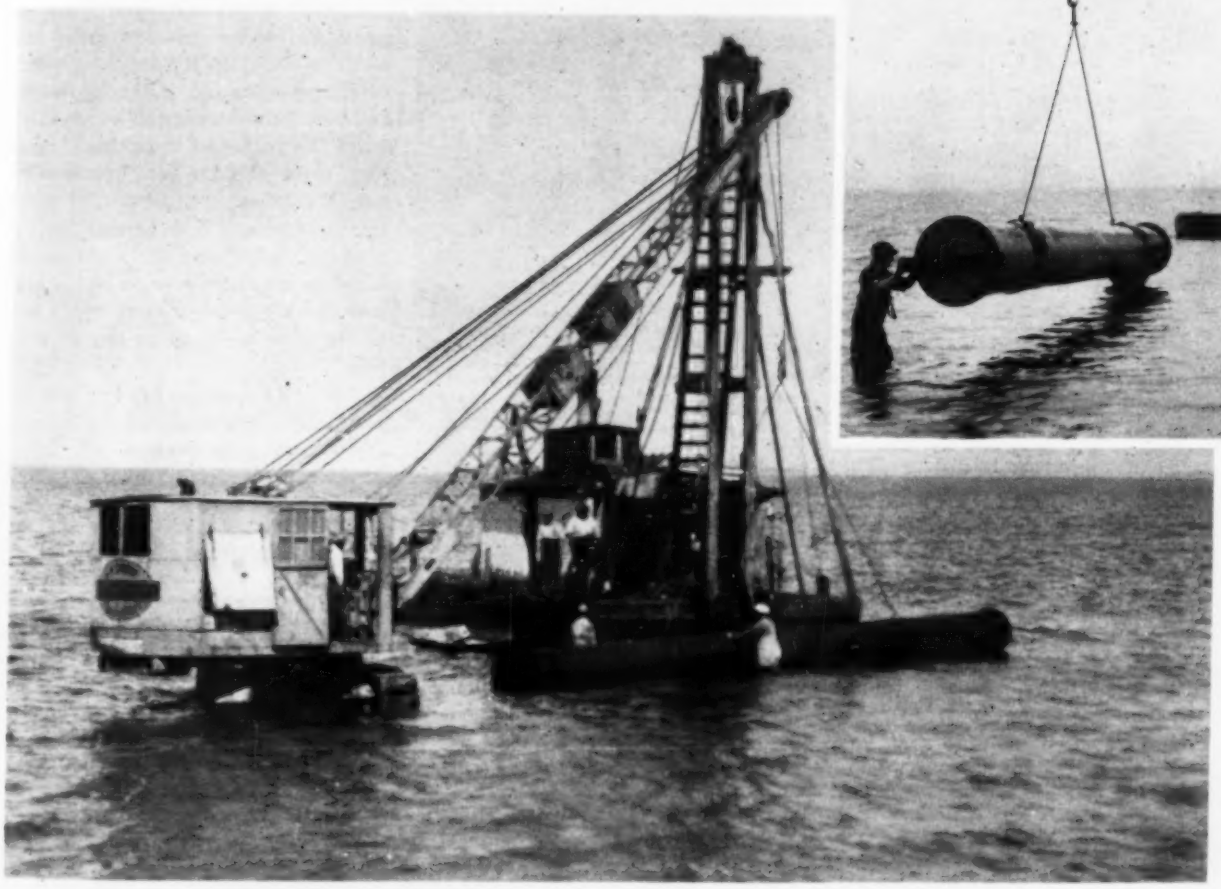
SUBMARINE INTAKE

Is 30-In. Steel Pipe With Bolted Joints

By W. S. WILLIAMS

Superintendent of Waterworks, Traverse City, Mich.

DRESS REHEARSAL. Diver familiarizes himself with details of pipe joint before making under-water connections on intake line.



PIPE-LAYING EQUIPMENT *(left)* included crawler crane and derrick scow. Wooden bulkheads *(above)* on ends of 40-ft. pipe lengths allowed sections to be floated prior to lowering to lake bottom for jointing by diver.

WHEN THE CITY GOVERNMENT purchased the privately-owned waterworks in Traverse City, Mich., in 1900, its equipment consisted of two Walker pumps having a 24-hr. capacity of 500,000 gal. each, with an 8-in. intake pipe extending 800 ft. into Lake Michigan in about 20 ft. of water. Proving inadequate, this first intake was soon replaced by a 16-in. line which served until a cross-compound Snow pumping engine, with 5,000,000 gal. daily capacity, was purchased. This necessitated a still larger intake, and a light 24-in. steel pipe was installed which, considering its relatively low cost, rendered satisfactory service for many years. Recently, however, it was discovered, upon inspection by divers, that it might not be safe to depend on the old pipe for any longer time than it would require to install a new intake line.

Though there are naturally distinct limitations to the appropriation of any small city, it was believed advisable to install a line with sufficient capacity for a community twice as large as the present population of Traverse City—one which would be ample for a city of 25,000 people—and it was thought best to procure a type of pipe which could be expected to withstand corrosive agencies and render longer service.

The 30-in. pipe finally chosen to connect with an intake crib in 45 ft. of water located 1,700 ft. from shore was purchased from The Taylor Forge & Pipe Works, Chicago. Rolled and hammer-welded from ⅜-in. plates of high quality open-hearth steel, there were certain processes inherent in its production which assured protection from corrosion without entailing the expense of purchasing the highest priced piping materials. In making the pipe steel plates are first rolled into shape. The overlapping edges are then heated with a special water-gas flame from furnaces on both sides and welding is accomplished by forging between hammer and anvil, not along a narrow seam, but over a comparatively wide area. The resulting pipe is solid and seamless in appearance. No internal stresses are set up in welding which the annealing and re-rolling processes do not correct. The finished hammer-weld pipe is no more susceptible to corrosion than the plates from which it was rolled. As an additional safeguard, the pipe is asphalt-coated, hot-dipped and vertically drained. The coating is extremely smooth and glossy, closely adherent, and highly resistant to corrosion.

The new pipe was unloaded from cars and transported from shore to a derrick scow by a Koehring crawler crane. It was then lowered to a diver. The joint used was an exceedingly simple bolted socket joint with retaining shoulder. Owing to the uniformly high strength and ductility of the pipe it was possible to form these flexible joints on the extreme ends, integral with the pipe, permitting the line to adjust itself to slight irregularities in the contour of the lake bed. These joints have the fewest parts of any flexible joint and are of the non-separable type. An illustration shows the diver acquainting himself with the construction of one of the joints above water, before making the under-water connections. The availability of the pipe in 40-ft. lengths also reduced the number of joints required. The pipe was installed without accidents or difficulties.

Great care was taken to prevent damage to the new intake line from the elements or because of ice piling up near shore. The pipe was covered with sand for about 300 ft. out into the lake and entrenched from shore line to pump house at least 2 ft. below the water line.

Second of a Series of Four Articles:

PUTTING SYSTEM TO WORK IN FIELD AND OFFICE

2 . . . Preparing Bills of Material for Complex Installations

By GEORGE E. DEATHERAGE
Superintendent of Construction, South Charleston, W. Va.

BLUEPRINT PLANS of installation are used by engineers as basis for preparing bills of material.

BEFORE ANY WORK can be constructed in the field, it is necessary that the material required be listed and purchased at one time or another. Obviously the prompt and complete listing of the material required for work of any size has advantages that must not be ignored if the contractor is to obtain the lowest prices and the greatest efficiency in performing the work in question.

● In complex installations demanding the supply of numerous and varied materials, such as pipe fittings, copper tubing, cable, wire, acid-proof brick, etc., savings through quantity purchasing become a vital question. A great many concerns handling fittings and other material of a like nature offer free freight to destination when the amount of the order exceeds 300 lb. The extras on copper tubing, in accordance with the quantity ordered, vary from ¼ to 12c a pound. The difference between less-than-carload and carload prices on acid-proof brick is 100%. The contractor who loses such savings through a lack of systematic procedure is missing an opportunity to conserve his cash and make an easy profit. Likewise, failure to place the right materials in the hands of the workmen in the correct quantity and quality at the right time is a source of economic loss for which no reasonable excuse can be found.

"Economies through bulk purchasing alone pay for all necessary clerical help, leaving all the other advantages to accrue as a well-deserved additional profit beyond that contemplated."

● Although it is not possible in every case, the ideal to be reached is to list all the like materials for the entire job, take competitive bids and buy the entire amount in one order. It seems unnecessary to emphasize that the larger the order the cheaper the purchase price and transportation costs.

● In general it is good practice to bill or list all the materials required by any one drawing on a standard bill form which is keyed to that drawing. For illustration, drawings for plant construction are generally prepared as follows: (1) Building foundations; (2) Structural steel; (3) Building walls; (4) Masonry; (5) Roof slab; (6) Equipment foundations; (7) Equipment; (8) Piping; (9) Electric wiring; (10) Power lines, etc.

● After all the detail bills for each drawing are prepared on a standard form (see illustration), they are summarized and all similar materials from all bills totaled for purchase. The manner in which materials are listed on such a form such as shown and the use to which they are put after preparation is in general as follows:

1. In the upper left hand corner, under "SK." (sketch), note the number of the sketch (if one exists) that details the material.
2. Under "Drawing Number", note the number of the general drawing from which the materials are being listed, for purposes of identification and record.
3. After "Date Received", note the date the drawing was received. This is necessary in case the drawing is revised and it is necessary to revise the bill of material, altering the quantity or nature of the materials to be purchased.
4. After "B/M No.", note the number of the bill. It is good practice to number all bills consecutively as a means of ready reference. If the supplier is instructed to put this number on the goods and shipping papers, it will facilitate handling in the field. By means of a cross-index file, if one knows the B/M No., the drawing to which it belongs can be found instantly. This, in turn, means that the field force can locate just where the material is to be used and what it is to be used for.
5. After "Job", note the name of the building or process covered by the general drawing above named, which will be the same as noted in the drawing title.
6. "W.O." Under this heading state the work order number, which is necessary for accounting purposes.
7. After "Job Detail", state the detail of the work covered by the material listed, such as piping, tank linings power feeders, etc.

"Failure to place the right materials in the hands of the workmen in the correct quantity and quality at the right time is a source of economic loss for which no reasonable excuse can be found."

PURCHASING DEPARTMENT is guided by bills of material in placing its orders for project.

8. After "Date Listed", state the date the B/M was prepared, and after "By" give the name of the person preparing it.
9. After "Charge", give the cost classification, in accordance with the cost classification being used at the time.
10. The "Date to Purchasing Dept." should be noted as showing the date the completed bill was sent through for purchase.
11. "Ch." (checked). Initials or name of individual checking the B/M listings.
12. "App". (approved). Name or initials of the person checking the B/M.
13. "Date of Revision" and "Issue Number" (in upper right hand corner). If it is necessary to revise the B/M, note the date under "Date of Revision" and the number of times that it is issued under "Issue Number"

Date of Revision	Issue Number
3-3-33	2

Sk. B-15478

BILL OF MATERIAL
CONSTRUCTION DEPARTMENT

Dwg. No. A-33457

Date Rec. 2-25-33 B/M No. 1760 Sheet No. 1 of 1

Job #2 Process - W. O. W.P.-669

Job Detail Refining Still Unit

Date Listed 3-3-33 By J.T. - N.Y. Charge 155-35

Date to Pur. Dept. 3-7-33 Ch. W.R.S. App.

No. Pcs.	Size	MATERIAL AND DESCRIPTION	Mark	Req.	P. O.	REMARKS
1	1-3/8"x9"	Steel Flange, Dwg. B-33455, Part #2	P-314	R3299		Secure from stock at stores
1	1-3/8"x4-5/8"	ditto Dwg. D32384	"	"		
1	1-3/4"x6-7/8"	Comp. Asbestos Gasket	"	R3355		
1	1-3/4"x2-15/16"	ditto	"	"		
8	5/8"x2-1/2"	Bolts with hex. nuts	"	R3356		
4	1/2"x1-3/4"	ditto	"	"		
15'0"	1-3/8"	O.D. x #16 Aluminum Tubing	"	R3270		
		This issue cancels and supersedes issue #1 - B/M No. 1760 dated 2/6/33.				

BILL OF MATERIAL FORM filled in by Construction Department in accordance with directions set forth in text of accompanying article.

Example: If the B/M has been issued twice before, then the present issue would be No. 3.

14. Number of Pieces ("No. Pcs.") State here the total number of each quantity noted; covers all of the items of a similar nature.

15. "Size". Detail this as accurately as possible. If a special item cannot be identified or purchased from stock, and a drawing must be consulted, note this information under the "Remarks" column, stating the number of the detail sketch, such as Sk. 1324. If the sketch has not been prepared at the time the B/M is made, write the word "Detail" under the "Remarks" column. This is notice to all that a sketch must be prepared before the article can be purchased or installed.

16. "Material and Description". Give a definite description of the material here, such description being in accordance with manufacturers standards.

17. "Mark". Give each item an identifying number, which in all cases should be the number of the item as noted on the drawing. If no number appears, assign a number, making sure that this same number is not duplicated for any other items.

18. "Requisition". This column is for noting the requisition number on which the order for the material has or will be placed; this is in case the take-off man makes up the requisition and forwards to the purchasing department.

19. "Purchase Order". To be filled in by the purchasing agent or individual actually making out the order.

20. "Remarks". Under this item give all references for each item, as to special drawing number, references to special specifications that cannot be given elsewhere.

● It is important that copies of all material sheets be sent to all interested parties and that special pains be taken to see that they reach the foremen in the field. On large work, it is usual to send copies to the job stores keeper, purchasing agent, field engineer, engineering department, and job foreman.

● If the billing has been properly done and checked, each person having to do with the construction has a complete set of bills for each working drawing in his possession. Details of organization, of course, vary with each job, but in the main it is just as important to have a complete material bill as it is to have the working drawings.

● The purchasing agent has definite quantities and specifications on which to purchase; the stores keeper easily checks, records, stores and issues the necessary items; and the job foreman has an exact list of what is required. Haphazard and frequent purchases of similar items is eliminated, confusion in job stores is at a minimum, and everyone interested knows the exact position of all materials at all times.

● It is the writer's experience that resulting economies through bulk purchasing alone pay for all necessary clerical help, leaving all the other advantages to accrue as a well-deserved additional profit beyond that contemplated.

"The ideal to be reached is to list all the like materials for the entire job, take competitive bids and buy the entire amount in one order."

"It is good practice to bill or list the materials required by any one drawing on a standard bill form which is keyed to that drawing."

IN THE FIELD material clerk is furnished with complete file of bills of material.

NEXT MONTH the third article in this series by Mr. Deatherage will discuss "Unit Cost Reports".

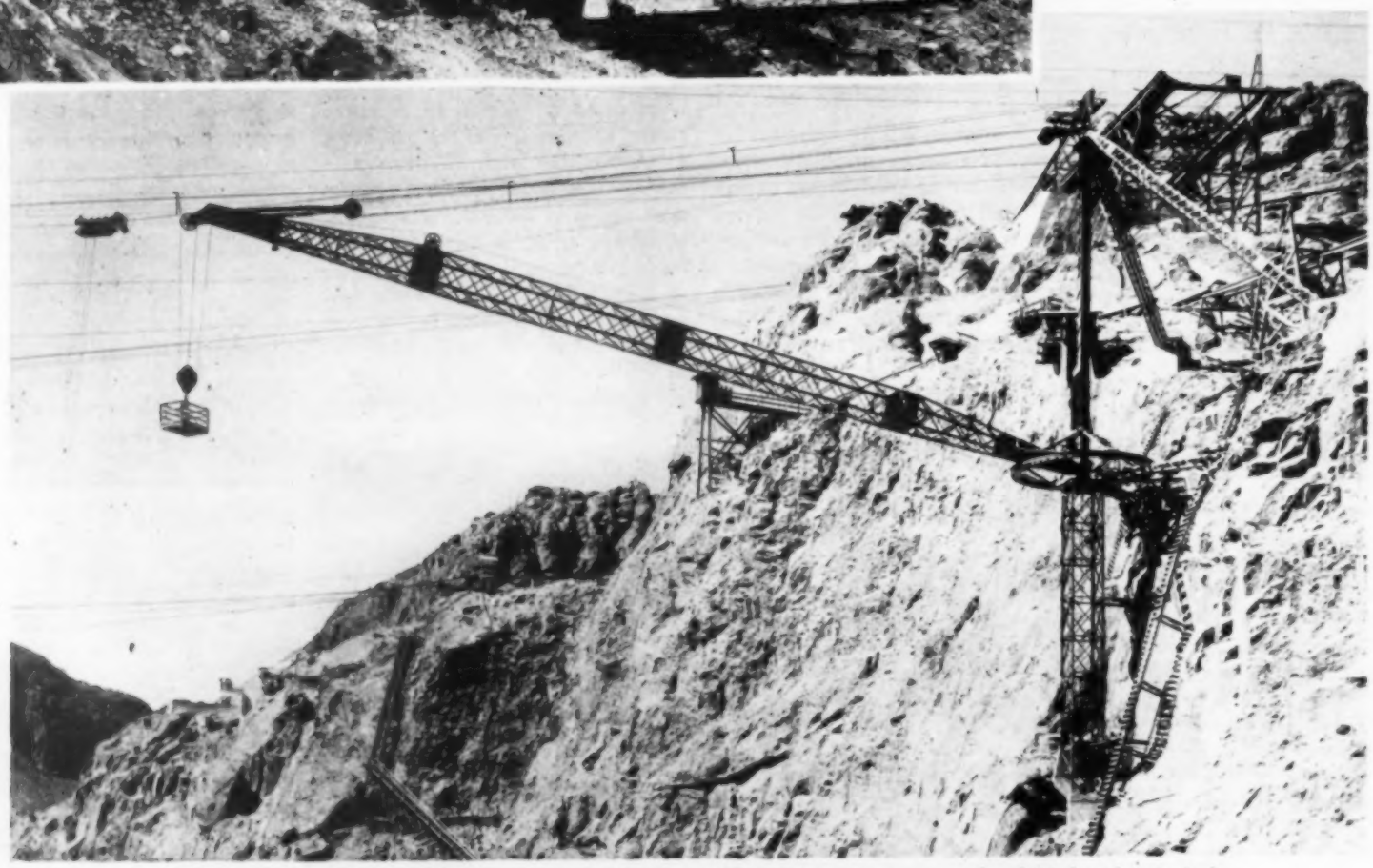
Getting Down to

DETAILS

[Close-up Shots of Job Methods and Equipment]

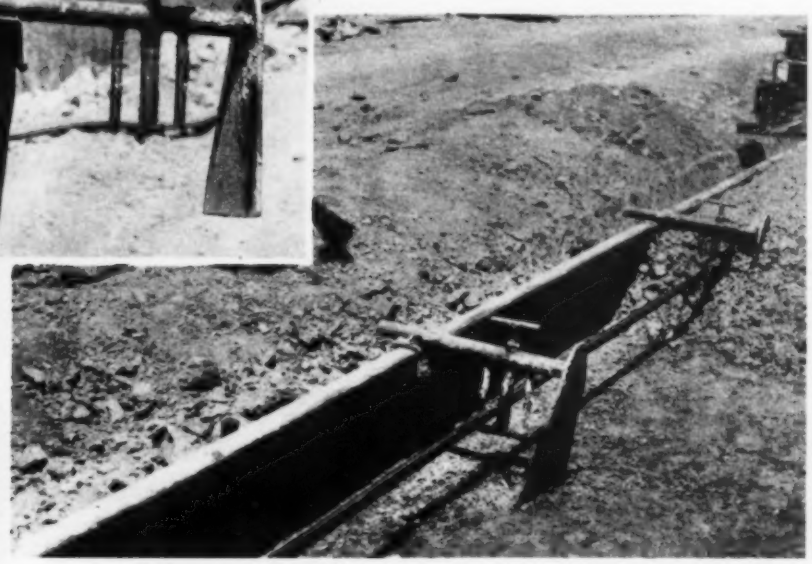
"BARN-RAISING" METHOD is applied by American Rolling Mill Co., at Middletown, Ohio, to erection of low-cost house, developed by R. F. Berryman. Wood frames for walls are built flat on ground and sheathed with light-gage Armco corrugated metal sheets upon which special Steelasco asphaltic binder is spread as base to insure adherence of stucco mortar. Completed side walls are raised to vertical position and tied together with steel strips.

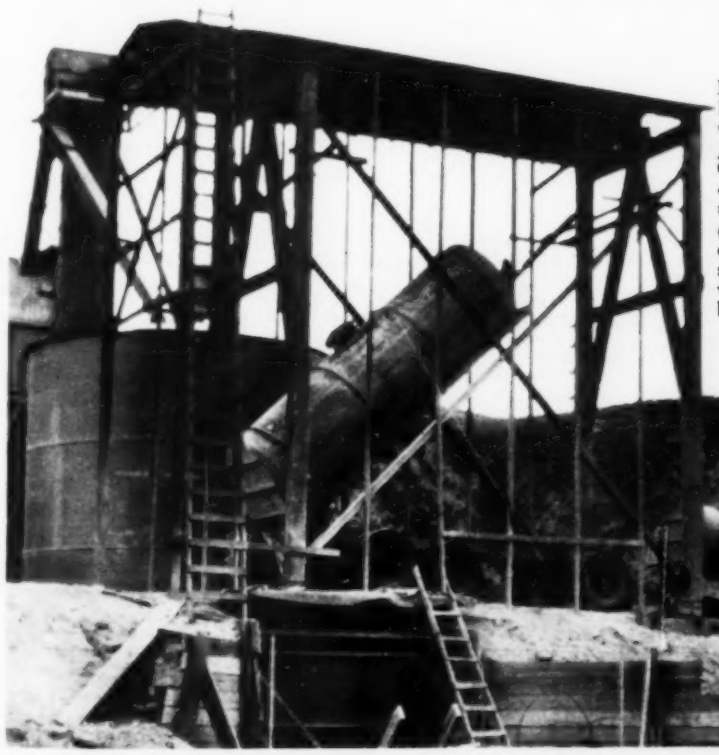
PLAYING BOTH ENDS *(left)* against the middle. On realignment of California highway north of Los Angeles Weymouth-Crowell Co. equips Caterpillar "70" Diesel tractor with bull-dozer blade on front and Le Tourneau rooter on rear end.



DIFFICULT DERRICK MOUNTING. For concreting four 384-ft. high intake towers and end blocks of main body of Boulder Dam, Six Companies Inc., has installed steel stiff-leg derricks with 180-ft. booms on the almost vertical walls of Colorado River canyon. The derricks, on structural steel towers, pick up 8-yd. buckets of concrete delivered by railway flat cars to transfer point below concrete base of supporting structure.

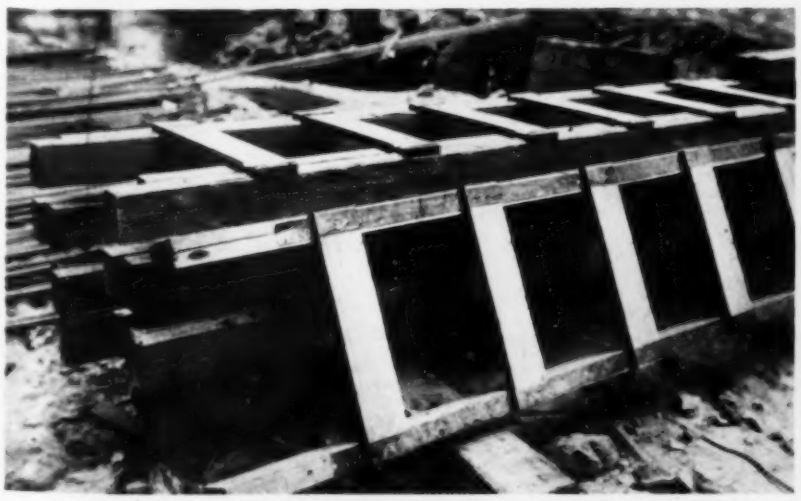
SUPPORTS for dowel bars *(below)* and for marginal steel reinforcing bars at *(right and in insert)* have been designed and made by Arcole Construction Co., of Niles Center, Ill., for use on state highway contracts in Illinois. A turn of the handle *(insert)* releases the support from the bar and allows it to be withdrawn for repeated re-use. — *Photos from ERNST LIEBERMAN, Chief highway engineer of Illinois.*

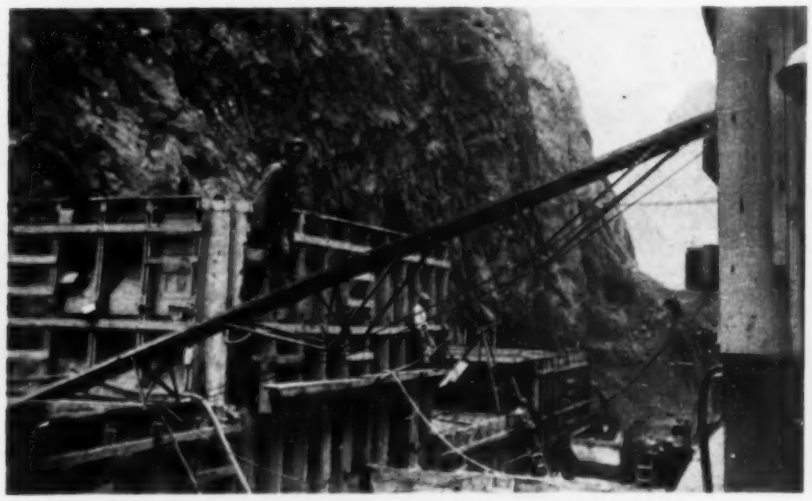




BULK CEMENT DUMPER. On Ridge Route highway cutoff, in California, Jahn & Bressi Construction Co., of Los Angeles, receive cement in motor truck and trailer 100-bbl. tank bodies *(left, below)* which are upended and discharged into steel receiving hopper from which cement is transferred by screw conveyor to 1,500-bbl. storage bin.

LOADING HOPPER, fed by crane bucket, equalizes supply of concrete for transfer by 2-wheeled buggies to floor forms of Black River highway bridge at Pocahontas, Ark.—*Photo, U. S. Bureau of Public Roads.*





SAFETY FIRST. Two details of equipment at Boulder Dam, designed by Six Companies Inc., to prevent accidents. LADDERS *(left)* are fitted with continuous metal strips to hold rungs in place. TRUSSED FOOTBRIDGE *(right)*, like gangplank, affords workers safe means of passage over irregular surface of dam caused by varying heights of columnar concrete blocks forming main body of structure.

POWER SHOVELS, TRUCKS AND TRACTOR TRUCKS move sandy clay soil from reservoir area to dam embankment, containing 180,000 cu.yd., where bulldozers and rollers spread and compact material.

Reservoir Area Supplies Fill for
ROLLED EARTH DAM

A RICH SANDY CLAY excavated by power shovels within the reservoir area and transported by crawler-mounted or pneumatic-tired trucks, depending upon the length of haul, has furnished practically all the material for a 180,000-yd. rolled earth fill dam with concrete corewall being constructed on Tar Run, near Pottsville, Pa., for the Pottsville Water Co. by the Vang Construction Co., of Cumberland, Md., and Pittsburgh. Concrete for the corewall and smaller structures was produced by an unusual set-up involving dry-batch delivery from a commercial plant to truck mixers at the job.

Description of Dam—Tar Run reservoir will provide an emergency storage supply of 200,000,000 gal. for Pottsville and surrounding towns served by the Pottsville Water Co. The drainage area of the reservoir comprises only 1.13 sq.mi., and the average runoff for the last 10 years has been 1.77 sec.-ft. An area of 48 acres will be flooded by the reservoir.

COREWALL CONCRETE, delivered by truck mixer, is handled into forms by bottom-dump bucket suspended from crane boom.

To impound the runoff of the Tar Run watershed, the water company is building a rolled earth-fill gravity dam having a crest length of 1,785 ft. and a maximum height above streambed of slightly more than 50 ft. The rolled earth embankment is designed with a top width of 20 ft. and with equal upstream and downstream slopes of 2:1 from the crest to an elevation 30 ft. below the top. From this level to the ground, a flatter slope of 2½:1 is used. Both upstream and downstream slopes are paved with loose one-man stones.

Discharge of water from the reservoir will be controlled by gate valves in a 20-in. cast-iron outlet pipe 315 ft. long which passes through the corewall at right angles and which is inclosed in a 4x4-ft. reinforced-concrete box with cutoff walls 1-ft. thick spaced 20 ft., c. to c. Flow through the pipe is controlled by a central gate valve which is reached by descending through a concrete tower rising vertically at the center of the embankment. In addition, the outlet system is equipped with two gate valves protected by a rubble masonry gatehouse near the downstream toe of the embankment.

Construction Procedure—A gang of ten laborers and a foreman cleared the 48-acre reservoir area of trees and brush, averaging 1 acre a day. Two Koehring 1½-yd. gasoline shovels followed the clearing gang, stripping topsoil to an average depth of 18 in. over the entire embankment and reservoir area. The shovels loaded the topsoil into Linn crawler-mounted trucks which hauled the material beyond the limits of the reservoir and dumped it in spoil banks.

Excavation for the corewall trench was started by one of the Koehring

EARTH-FILL DAM 1,785 ft. long and 50 ft. high will impound emergency water storage of 200,000,000 gal. Dam has concrete corewall and paved slopes, both upstream and downstream.

machines equipped with a ⅜-yd. back hoe attachment. As the depth of the trench excavation increased, numerous springs encountered by the excavators necessitated the installation of wood sheeting and shoring to hold the earth walls through most of the length of the trench. Average excavation to a depth of 10 ft. uncovered a conglomerate rock and boulder formation which afforded a satisfactory foundation for the corewall. To prevent any fracturing of the foundation, use of explosives was prohibited. Workmen carefully removed all loose material and thoroughly cleaned the rock by scrubbing

SPILLWAY below crest is paved with local stone placed by hand.

At the dam, two Caterpillar 60-hp. tractors equipped with bulldozers spread and sorted the material dumped by the trucks before it was compacted in 6-in. layers by two Buffalo-Springfield 10-ton gasoline rollers. A large force of men was employed in removing any stones exceeding 6 in. in the least dimension from the freshly spread material. The oversize pieces were loaded on stone sleds which were drawn to the outside slopes of the fill by Caterpillar 60-hp. tractors. Workmen placed the stones by hand to conform with the slopes designated by the engineers.

PRESSURE GROUTING is done with machine supplied with air by portable compressor. Grout is forced into 2-in. holes spaced at 4-ft. intervals along corewall trench.

its surface with stiff wire brushes.

Following the thorough cleaning of the foundation rock, inspectors of the Water and Power Resources Board of Pennsylvania directed the installation of 2½-in. grout pipes, which were spaced about 4 ft. apart along the center line of the wall. The grout pipes first were placed in vertical position and were grouted solidly to the foundation rock; concrete then was placed around the pipes and against the wood sheeting to ground level On the day following the placing of this concrete, a crane pulled the wood sheeting.

30-FT. SECTION of rolling steel wall form is installed in position preparatory to placing 10-ft. lift of concrete in corewall.

Four 2-in. diamond core drills operated by Sprague & Henwood, Inc., subcontractor, of Scranton, Pa., drilled through the 2½-in. pipes into the foundation rock to a depth not exceeding 20 ft. The four drills sank a total of about 5,000 lin.ft. of grout holes, maintaining an average daily drilling rate of 20 ft. per machine. A pressure grouting machine served by a Gardner-Denver portable compressor, was used to grout these holes with a 1:10 cement grout.

Concreting Corewall—Of the total amount of 5,300 yd. of concrete required for the job, almost 5,000 yd. went into the corewall, which has a maximum thickness at its base of 3 ft. and a constant batter of ¼ in. per ft. on each side to a point 2 ft. below the top of the embankment, where the thickness is 12 in. A unique combination of batching and mixing operations featured the production of all concrete on the project. Measured 2-yd. batches of cement, sand and gravel were loaded into two-batch trucks at the central plant of the Pottsville Building Block Co., in Pottsville. These trucks delivered the dry batches at the job into special bins designed to charge the drums of two Jaeger 2-yd. truck mixers mounted on Mack chassis. The truck mixers discharged the concrete into Dravo bottom-dump buckets which were handled into the forms by a Koehring crane.

Corewall concrete was placed in 10-ft. lifts, the contractor using two 10x 30-ft. sections of Blaw-Knox rolling steel wall forms for this work. The wall forms traveled on structural steel rails secured to the next lower lift by bolts embedded in the concrete. These bolts also served to hold the wall panel forms in position for placing the next lift of concrete.

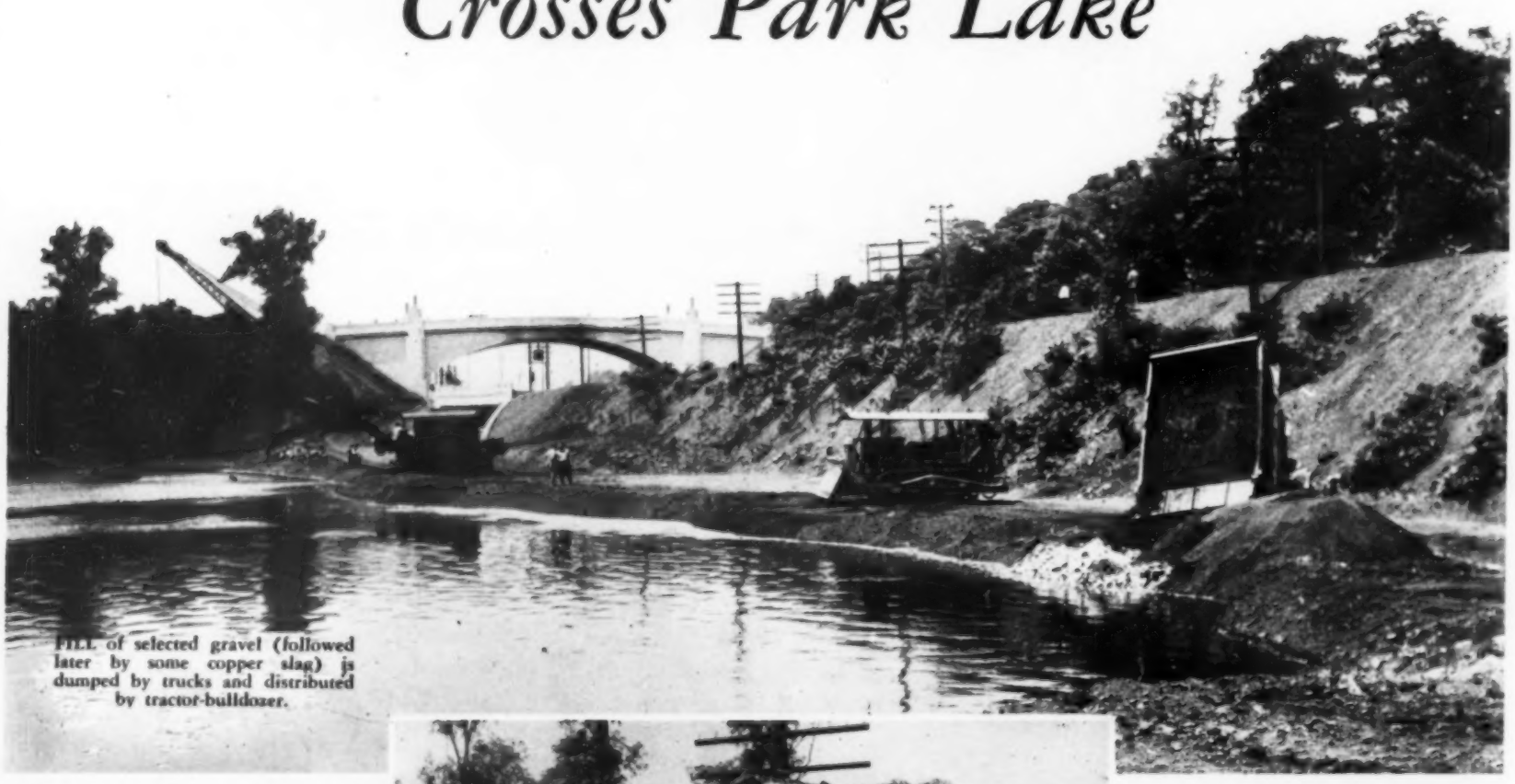
Embankment Construction—The rich sandy clay of the reservoir area contained good proportions of fine and coarse material, assuring ready compaction under the roller and a dense fill in the earth embankment of the dam. After harrowing the embankment area to obtain a good bond with the existing subsoil, the contractor began to excavate fill material with the two 1½-yd. gasoline shovels. No material was removed from the reservoir area within 100 ft. of the upstream toe of the dam. On the shorter hauls, four 6-yd. Linn crawler-mounted trucks transported material from the shovels to the dam; Mack 5-ton trucks operated on the longer hauls.

Supervision—N. J. Beisel, general manager and chief engineer, was in general charge of the project for the Pottsville Water Co., with E. A. Hilliard, resident engineer, directly responsible for field operations. For the Vang Construction Co., C. H. Flick, superintendent, supervised the work.

GATEHOUSE of rubble masonry is located near downstream toe of earth fill dam.

HIGHWAY FILL

Crosses Park Lake



FILL of selected gravel (followed later by some copper slag) is dumped by trucks and distributed by tractor-bulldozer.

TO PROVIDE A SOLID FOUNDATION for a section of New Jersey State Route 29, an important express highway, where it crosses one end of Weequahic Park Lake, in Newark, S. J. Groves & Sons Co., of Ridgefield, N. J., and Minneapolis, Minn., excavated about 13,000 yd. of mud from the bottom of the lake and built up a fill of selected gravel and copper slag on sound gravel bottom 10 to 16 ft. below water level. The portion of the highway crossing the lake was about 700 ft. long and comprised only one part of a contract which called for about 2,000 ft. of heavy grading in a section 1.47 mi. long, later paved with 42,000 sq.yd. of concrete by the same contractor. A crane, which operated alternately as dragline and clamshell excavator, removed the mud from the lake. Practically all the gravel for the fill was obtained from excavation on the right-of-way.

Construction Quantities—The 1.47-mi. project was the last surface-highway section in the link connecting Route 29 with Routes 21 and 25 (U.S.1) at an intersection in the Jersey meadows near the Newark Airport. Total wet excavation on the project amounted to 17,000 yd., and dry excavation aggregated 58,000 yd. All this grading was in a 2,000-ft. section near the west end of the project. In addition to the concrete pavement, the contract called for a concrete retaining wall, adjacent to a completed three-level grade separation structure, and a two-span overhead concrete bridge to carry the electric railway tracks of the Public Service Corp. of New Jersey. These structures were built under subcontract by James E. Gano, of Somerville, N. J., with transit-mix concrete. The retaining wall required 1,300 yd. of concrete.

THREE-WAY-DUMP WAGONS, hauled by tractors, dispose of lake mud in depression along railroad line.

D. O. McKAY *(left)* superintendent; F. C. Maschal, engineer, and E. Olson, general foreman.

Lake Fill — A Thew-Lorain crane equipped with a 50-ft. boom excavated the 13,000 yd. of mud from the bottom of the lake. Part of the time this machine operated a Williams 1-yd. clamshell bucket and the rest of the time it excavated the muck with a Page 1-yd. dragline bucket. The contractor added to the depth of the dragline bucket by welding on steel-plate sideboards to prevent spillage of the liquid muck.

Spoil from the lake excavation was loaded by the crane into two Athey three-way dump wagons of 7- to 8-yd. capacity. Each wagon was drawn by a 60-hp. Caterpillar tractor up an earth ramp to the grade of the adjacent main-line tracks of the Lehigh Valley R.R., which uses the middle level of the three-level grade separation structure. The tractors hauled the spoil a total distance of about 1,000 ft. and wasted it into a natural depression alongside the railroad embankment.

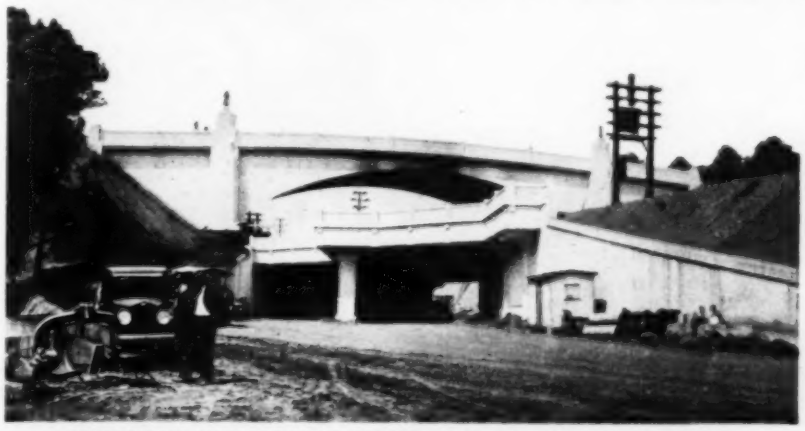
Of the 34,000 yd. of fill required for the 700-ft. section crossing the end of the lake, about 6,000 yd. consisted of copper slag obtained from a Newark

plant and trucked to the site. This material is heavy, weighing about 4,500 lb. per cubic yard, and varies in size from small particles to pieces 8 or 12 in. in maximum dimension. Up to a point several feet above water level, the fill consisted almost exclusively of selected gravel and sand obtained from excavation on the right-of-way. A Thew-Lorain 1¼-yd. shovel loaded this material into a fleet of rented trucks, about six in number, hauling 7 to 8 yd. each. These trucks transported the gravel and sand about 2,000 ft. and dumped it on the fill, where it was spread by a 60-hp. Caterpillar tractor equipped with a bulldozer. The layers of material as spread were compacted by the tractor and by truck traffic.

In addition to the fill across the lake, similar excavating and filling operations were required for a pond on the other side of the three-level grade separation structure. This pond had been drained at the time the grade separation structure was built. The contractor on the present work excavated 8 to 10 ft. of mud, amounting to about 4,200 yd., from the bottom of the old pond, and filled the depression with 6,000 yd. of gravel obtained largely from slope excavation for the retaining wall. Because of its location, it was necessary to install drains to keep this fill dry. The drainage system designed by the State Highway Department engineers called for 8-in. French drains of bitumen-coated, perforated, corrugated metal pipe. To facilitate the cleaning of these drains, if ever necessary, the pipes were connected into the manholes which serve the highway sewer system.

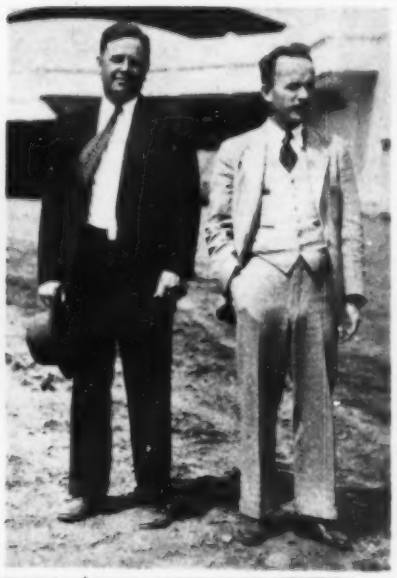
Administration—Grading and paving of the 1.47-mi. section were directed by C. F. Bedwell, construction engineer for the State Highway Commission. H. D. Robbins, district engineer, was in general charge of the work, with Stephen A. Strait, Jr., resident engineer, directly responsible for field operations.

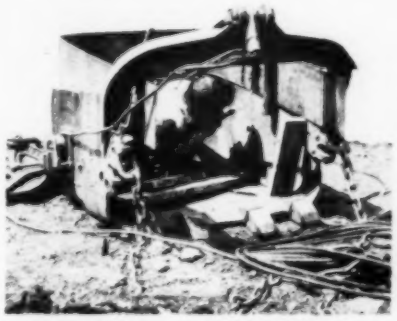
For the S. J. Groves & Sons Co., John B. Matthews is general superintendent. D. O. McKay, superintendent, assisted by E. Olson, general foreman, was in charge of operations on the project.



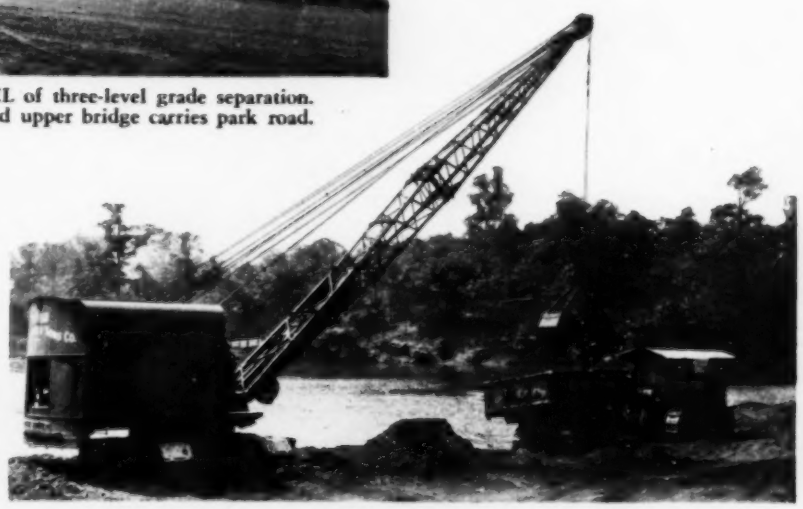
HIGHWAY USES LOWEST LEVEL of three-level grade separation. Intermediate level is for railroad and upper bridge carries park road.

JOHN B. MATTHEWS (*below, left*), general superintendent for S. J. Groves & Sons Co., and STEPHEN A. STRAIT, JR., resident engineer for State Highway Department.

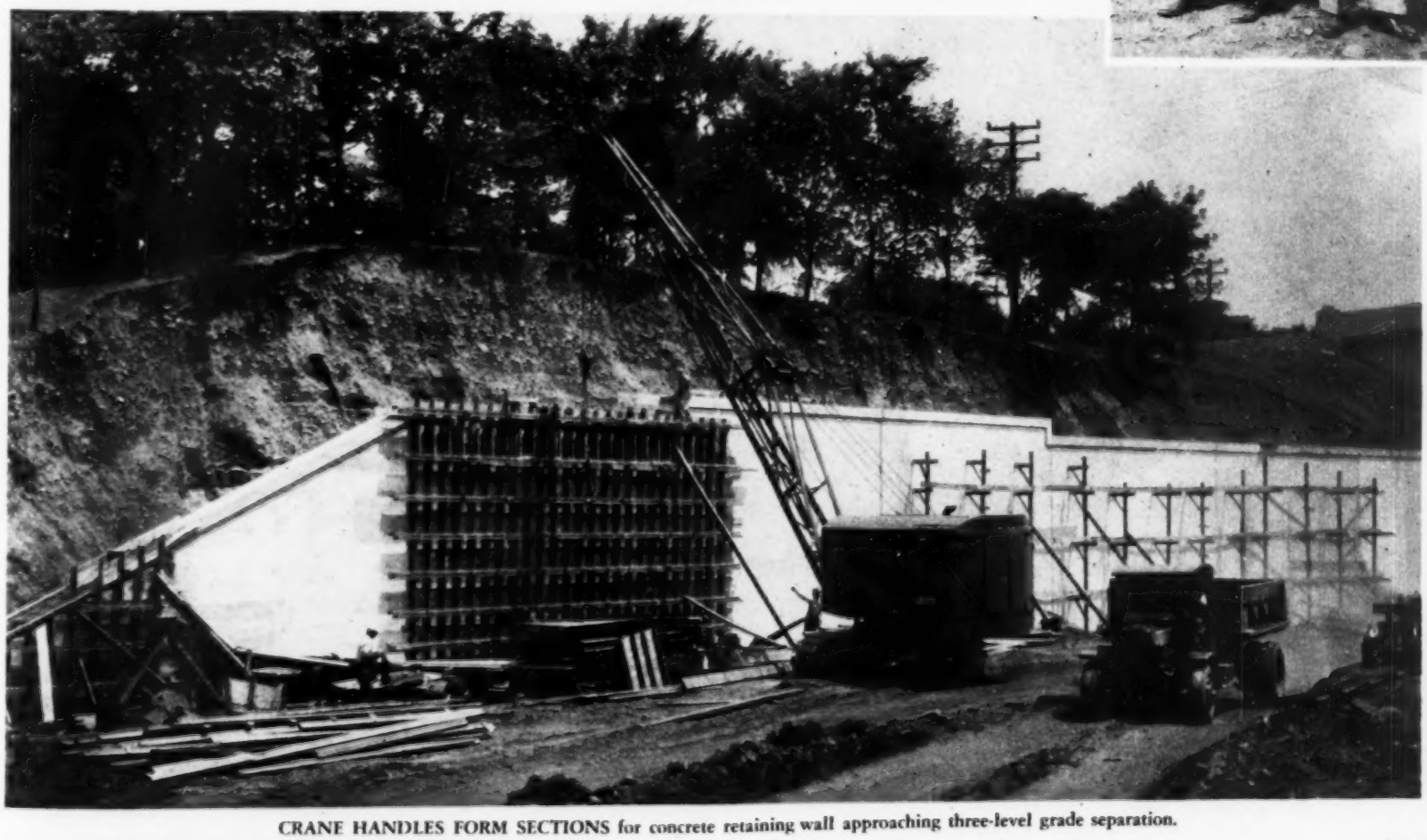




STEEL-PLATE SIDEBOARDS are welded on dragline bucket to prevent spillage of lake muck.



CRANE, operating alternately as clamshell and dragline, excavates 13,000 cu.yd. of mud from lake bottom, loading material into three-way-dump wagons hauled by 60-hp. tractors.



CRANE HANDLES FORM SECTIONS for concrete retaining wall approaching three-level grade separation.

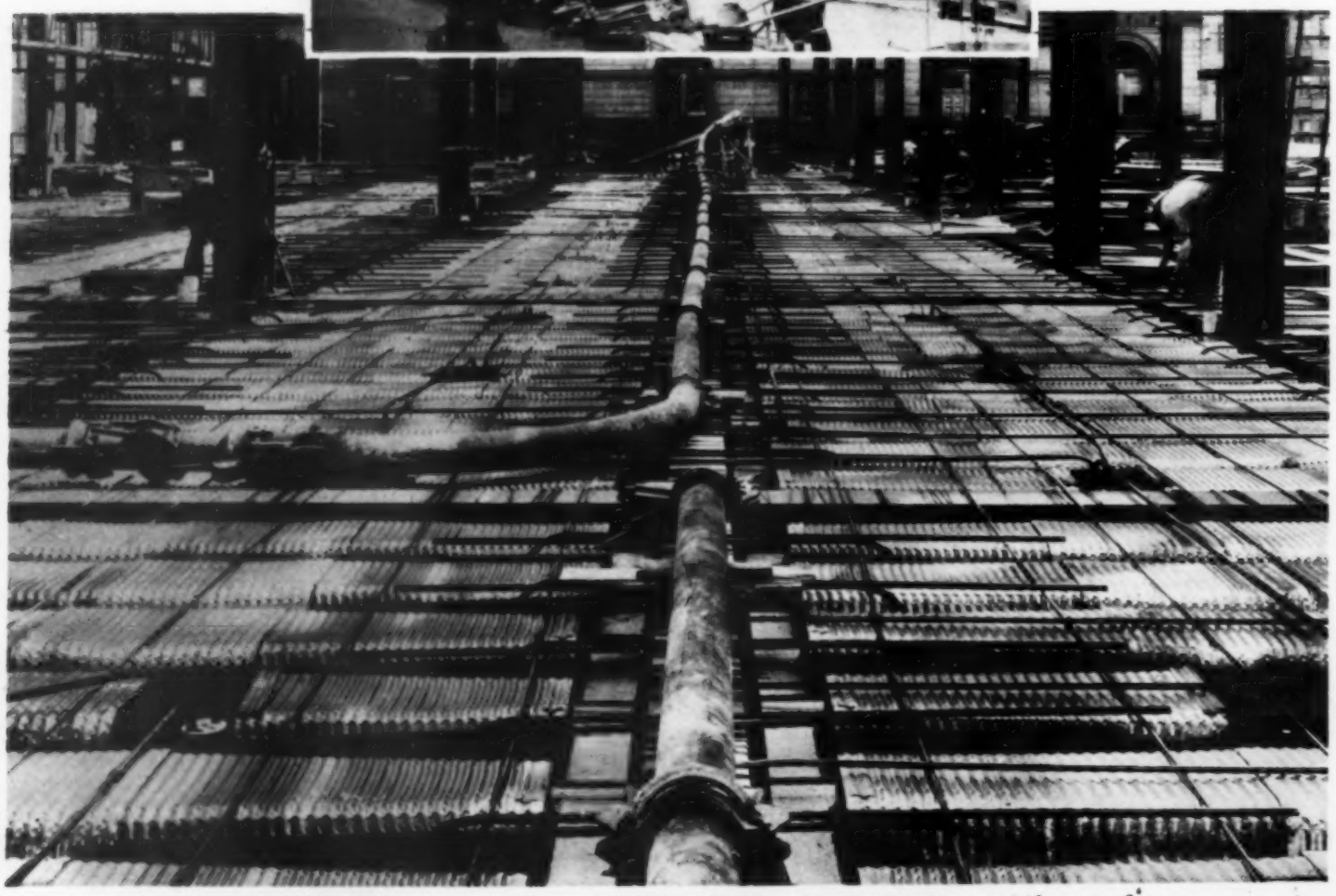
PUMPED CONCRETE

Cuts Cost of Floors and Roof of Five-Story Albany Post Office

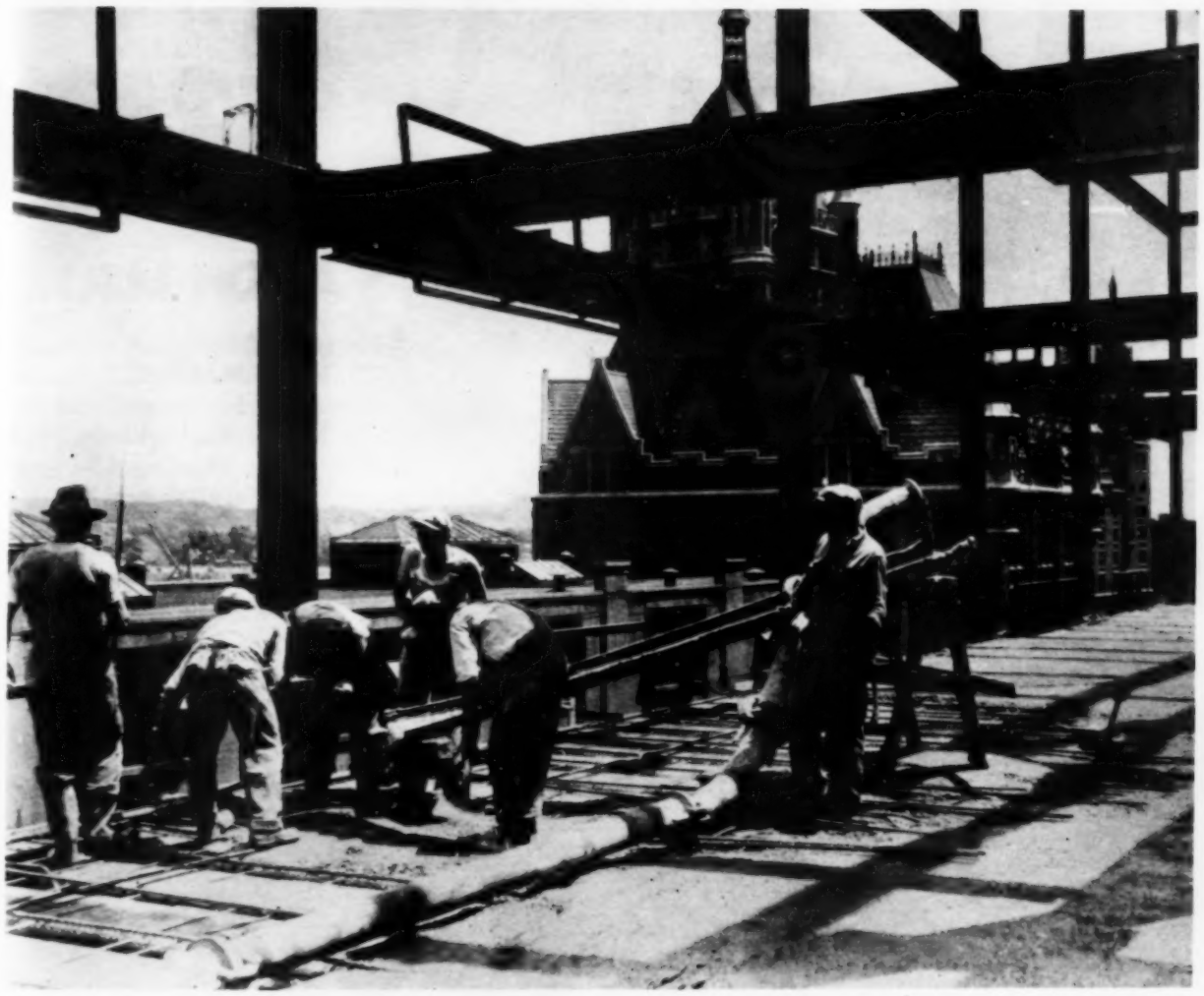
A DIRECT-ACTING PISTON-TYPE CONCRETE PUMP, installed outside one of the basement walls, delivered through 6-in. pipe line to the desired points for placing on the five floors and roof of the Albany, N.Y., Post Office 5,000 cu.yd. of ready-mixed gravel concrete at an average rate of 18 cu.yd. an hour, completing the work in 12 weeks and forcing the material a maximum distance of 100 ft. vertically plus 260 ft. horizontally. Under the conditions existing on this job, the Eureka Fireproofing Co., Inc., of Long Island City, subcontractor under Kenny Bros., Inc., of New York, general contractor, estimates that concreting by the familiar method of hoisting and wheeling would have required 16 weeks. In addition to the saving in time, the subcontractor claims for the pumping method a reduction in the cost of placing the concrete and an increased facility in distributing the material and reaching inaccessible parts of the building.

PIPE LINE rising from concrete pump at basement level to roof of Albany Post Office delivers concrete for floor arches.

Dimensions of Building—The Albany Post Office is a steel frame structure with five floors and a roof, each about 140x250ft. in area. Reinforced-concrete T-beam construction, with the beams running in one or two directions, was used to span the floor bays, which ranged from about 20 to 30 ft. in length. The floor arches were formed with corrugated metal domes. Depth



DISTRIBUTION LINES made up of pipe section equipped with quick-acting couplings are laid out on floor ready to receive concrete.



5,000 CU.YD. of concrete is delivered by pump and pipe at average rate of 18 yd. an hour directly to position in floor bays.

of the beams between the domes ranged from 6 to 14 in., and the cover concrete on top of the domes was 2½ in. deep. The floors averaged 7½ in. in thickness of concrete.

Pumping Layout — A Rex Pumpcrete single-chamber unit, made by the Chain-Belt Co., of Milwaukee, Wis., with a rated capacity of 20 cu.yd. of concrete per hour when pumping through a 6-in. pipe line 100 ft. vertically or 600 ft. horizontally, was placed by the contractor below street level along one of the basement walls where ready-mixed concrete could be discharged from agitator trucks directly into the hopper of the pump. The pump, which was a horizontal, piston-type unit, driven at 44 strokes per minute by a gasoline engine, had a piston chamber 8 in. in diameter equipped with reciprocating intake and discharge valves.

Concrete was fed from the hopper by gravity into the pump chamber and was forced in a solid stream, or column, through a pipe line of 6-in. stainless steel tubing by the direct pushing action of the piston, without the admission of compressed air or any other medium for floating or suspending the material in the pipe. The pipe line was made up of 10-ft. sections, weighing 150 lb. each, of 6-in. seamless steel tubing with quick-acting toggle-type couplings which were connected without threading or using a wrench. In all, the contractor had on the job 400 ft. of pipe line, including 90- and 45-deg. bends for making all necessary changes in direction. At times, as many as five bends were in use in the line. A 10-ft. tapered section, reducing in diameter from 8 to 6 in., connected the pump chamber with the standard 6-in. line.

Concreting Operations — Concrete placed at the Albany Post Office had an average slump of about 6 in. and contained coarse aggregate of ¾-in. maximum size. The pump handled this concrete with ease, as the machine is designed to pump any mixture having a slump of 3 in. or greater and containing coarse aggregate of 2½-in. size or less. Because the concrete was forced through the pipe line in a solid column, no segregation of ingredients occurred in transit, and the concrete discharged from the end of the pipe line in a steady stream, and not in large lumps or masses.

In concreting floor bays, the contractor elevated the discharge end of the pipe line about 5 ft. at the center of a bay, or midway between two bays, and distributed the material from this elevation by chutes. This method was preferred to the alternative procedure of distributing the concrete with a flexible hose because it eliminated the time lost in disconnecting and connecting the hose at each change in the length of pipe line. To facilitate progress during the day, it was customary to start concreting operations at the bay farthest

SINGLE-CHAMBER CONCRETE PUMP receives ready-mixed concrete from agitator trucks and forces it 100 ft. vertically plus 260 ft. horizontally through 6-in. pipe line.

"Now I know

SAID MR. L. CO

Early in 1932, Mr. Coluccio signed the orde
Chalmers Model "L" Tractor. After two
operation, he has ordered two more L's."
the Model 'L's' will do," he said. They a
fully . . . operating 12-yard carry-a scrape
yardages." (Below) Mr. Coluccio signing
in 1932. (At left) Two Model "L" rece

A Two to One Slope

The operator said he wouldn't have attempted to work on this slope with any other grader. It's a two to one slope on a fill . . . but the "L" and No. 14 Power Controlled Leaning Frame Grader do the trick. Why? Because the No. 14 is the only grader with a leaning frame — which permits the balancing of weight for efficient work at difficult angles.

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rrya scrapers . . . moving big
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l "L" recently delivered.

Inserted Valve Seats

This is one of the many mechanical features of A-C tractors which appeal to Mr. Coluccio and other owners. Inserted valve seats save fuel, save valve grinding, save money.

■ ■ ■

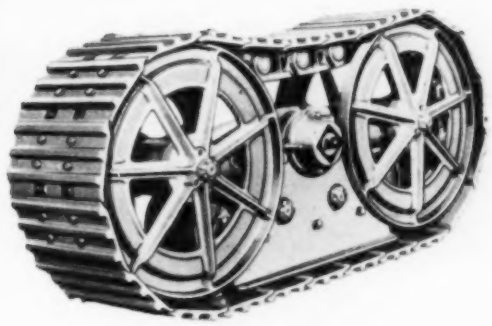
UNDIVIDED RESPONSIBILITY . . . It is to your advantage to buy your tractors and blade graders . . . tractors and wagons . . . tractors and elevating graders . . . patrol graders . . . power units . . . and other dirt moving equipment . . . from one source. Allis-Chalmers tractors, graders and wagons are built in several sizes . . . and work most efficiently with each other. Allis-Chalmers dealers can furnish complete equipment for earth moving operations.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

Tough Work? SURE!

But not for an A-C tractor. The "L" was the first tractor built with two speeds in reverse — a definite aid to bulldozing work. A contractor can't meet competition in bidding with old, obsolete equipment.

A "Real" Wagon Track . . .

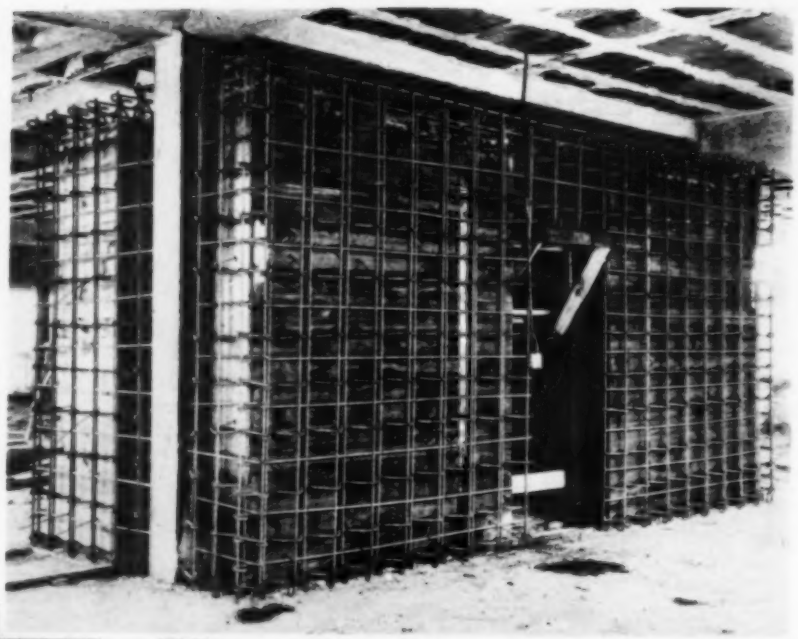


Yes Sir, the operator is smiling Those A-C Tracks pull easier an last longer. Just let them prov it on your job. Available wit A-C Wagons . . . or for replace ment on all makes of wagons

from the riser and to shorten the pipe line by taking off sections as the individual bays were completed. A pipe section filled with concrete weighed about 450 lb., and from 3 to 5 min. was required to remove a section from the line. One man operated the concrete pump, and eight men were employed in taking care of the pipe line and distributing the concrete.

Because of the time lost in making changes, pumping of concrete would not be so economical on thin floor sections. At the Albany Post Office, with an average concrete floor thickness of 7½ in., this time loss was not a dominant factor. It was possible to place 15 yd. of concrete in one bay, or perhaps 30 yd. of concrete in two bays, between changes.

At the end of a day's run, the pipe line was cleaned out to gun-barrel smoothness by means of a traveling plunger which was forced through the pipe by pumping water into the line. The traveling plunger, called a Go-Devil, was introduced into the pipe line by removing the section nearest the pump, dumping out the concrete, and installing the plunger in this section before replacing it in the line. This



TO REACH INACCESSIBLE POINTS, such as roof of this reinforced-concrete vault (*right*), hose from pipe line saves time and labor in placing concrete.

STEADY STREAM of concrete flows from discharge end of pipe line.

FRANK STRICK (left), in charge of job, and STANLEY SOBOCHA, in charge of formwork, for Eureka Fireproofing Co.

method of introducing the plunger caused the loss of about 2 cu.ft. of concrete from the section which had to be removed. Workmen followed the course of the plunger through the pipe line by tapping on the pipe with a hammer. When the plunger reached the last section of pipe line, pumping was discontinued, and the pump was opened to drain the water from the line. The end section of the pipe line then was disconnected, and the concrete and the traveling plunger were dumped out of the pipe.

By pumping concrete through a length of flexible hose at the end of the pipe line, the contractor greatly facilitated placement in the tops of several reinforced-concrete vaults, which could not be built until after the floors had been completed. The tops of these vaults, one of which is illustrated by an accompanying photograph, were within 2 ft. of the ceilings. By inserting the end of the hose in this narrow clearance and distributing the concrete over the top of the vault, the crew was able to place the material without difficulty.

Progress — When first beginning pumping operations, the crew averaged about 125 yd. per day. As the men became more proficient, they increased the daily production to a maximum of 195 yd., bringing up the average for the job to almost 160 yd. per day. The concrete was placed by pumping at a cost which compares favorably with placing costs by other methods.

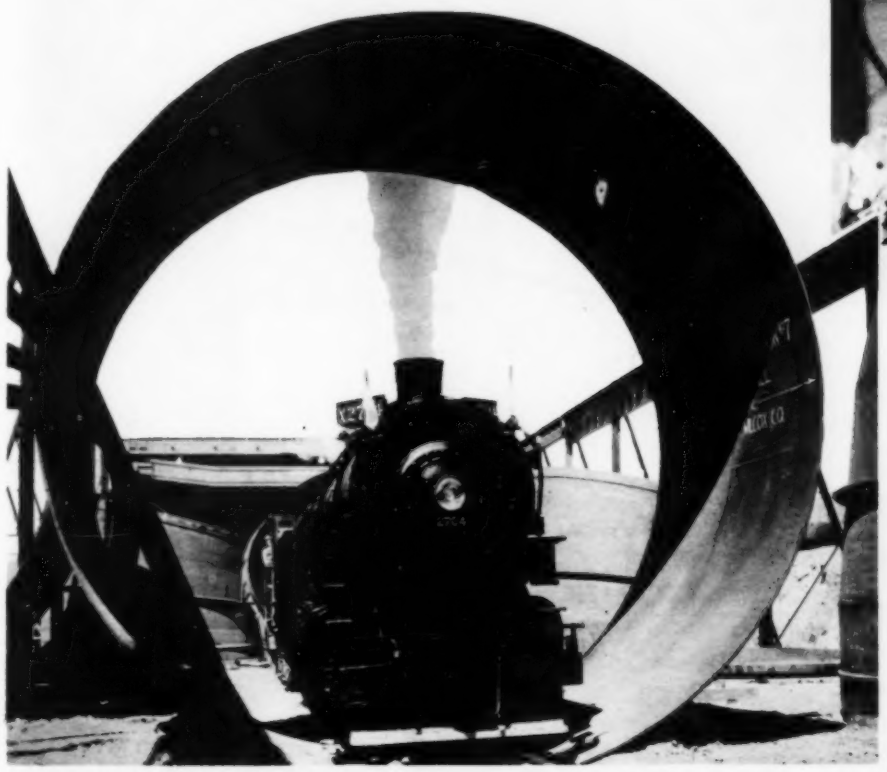
To meet the specifications, the concrete was designed to give a compressive strength of 2,000 lb. per square inch at 28 days. The contractor claims that pumping through a pipe line improved the density and quality of the concrete. This contention appears to be borne out by the fact that the average compressive strength of cylinders broken at the end of 28 days on this job averaged more than 3,000 lb. per square inch.

Direction — For the U. S. Treasury Department, E. L. Hesse, construction engineer, was in charge of all operations at the building, under the general direction of James A. Wetmore, supervising architect.

Frank Strick was in charge of the job for the Eureka Fireproofing Co., of Long Island City, N. Y., and the work was carried out under the general supervision of George Cohen and Felix Kogut, who direct all engineering and construction work for this concern. The general contract for the construction of the building was executed by Kenny Bros., Inc., of New York City.

JOB ODDITIES

A Monthly Page of
Unusual Features of Construction



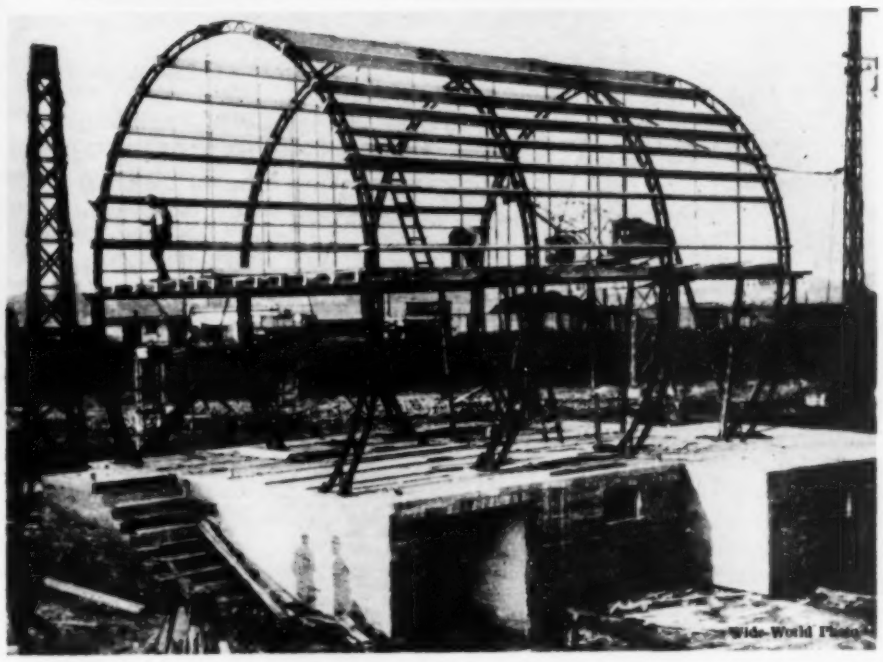
ROOM TO SPARE. Railway locomotive passes through one of the huge 30-ft. diameter welded steel penstock pipe sections which the Babcock & Wilcox Co. is fabricating under $11,000,000 contract at Boulder City, Nev., for installation in rock tunnels piercing sides of Colorado River Canyon at Boulder dam. Penstock contract requires welding of 45,000 tons of pipe into sections from 8½ to 30 ft. in diameter, with maximum thickness of steel of 2¾ in. Joint welds are inspected by X-ray equipment.

WHAT THE WELL-DRESSED RIVETER WILL WEAR when at work inside the 746-ft. steel towers on the Marin pier of San Francisco's Golden Gate bridge, to have world's longest suspension span of 4,200 ft. Safety equipment includes Bullard "hard-boiled" hats of stiff fibre, topped by head-light and supplemented by gas-mask as guard against lead-poisoning from fumes when hot rivets come in contact with red lead paint on steel of tall, chimney-like structure.

SISTER ACT Weighing only 8 tons, new Bucyrus-Erie ⅜-yd. crawler-mounted excavator *(left)* is picked up and swung around by a heavier dragline machine of the same industrial family.

Wide World Photo

STEEL HOOP HOUSE. Framework of new two-story and basement residential structure in Dusseldorf, Germany, *(right)* is in form of barrel, with absence of conventional vertical columns. Floor of second story is in course of construction. COMPLETED HOUSE *(above)* is sheathed and roofed to conceal cylindrical shape of steel frame.



Wide World Photo

Reconstruction of Sewage Plant Gives

WINTER EMPLOYMENT

TANKS of sewage treatment plant at Providence, R. I., during reconstruction and enlargement. In background, note bypass channel and end walls of existing tank being demolished.

RECONSTRUCTION of old tank requires demolition of 600 cu.yd. of concrete. Workmen cut trenches for new aeration tank walls.

SAND IS HEATED by steam from 10-hp. vertical boiler. Aggregates at central plant are piled on steam pipe grill.

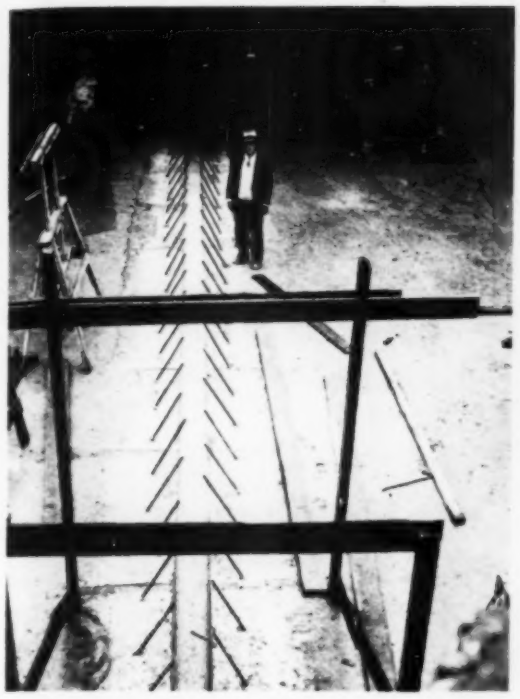
CENTRAL MIXING PLANT discharges concrete into truck for delivery to hand buggies at various points on job.

REBUILDING and enlargement of the Providence, R. I., sewage treatment plant, calling for a change from the old chemical precipitation process to the activated-sludge process and an increase in capacity from 30 million gallons a day to 75 m.g.d., offered an opportunity last year to the Department of Public Works to maintain employment through the winter when construction work in the department usually is at a low ebb. Construction forces were recruited from unemployed labor in the department, and an engineering organization to design and supervise the work was borrowed from the office of the city engineer. In general, conventional methods of heating and protecting concrete were followed, and an economical system of mixing and distributing the material was adopted to reduce the cost of placing small quantities of concrete over a large area.

Sewage Treatment Plant—The 30-m.g.d. capacity of the old plant was inadequate to take care of the present flow of sewage. In the old plant all screening operations were manual, whereas the new plant is cleaned continuously by mechanical means. The change to mechanical operation dispenses with manual labor, which was difficult to obtain for this work. Remodeling of the old plant called for installation of coarse screens and detritors and for the construction of primary settling tanks, aeration tanks and final settling tanks of reinforced concrete.

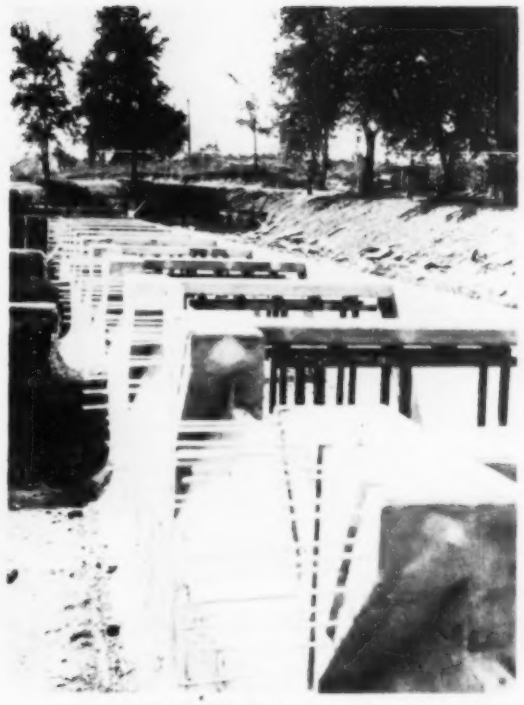
As a first step in the reconstruction of the old plant, the Department of Public Works built a reinforced concrete channel along the south, east and west sides of the old tank. This channel bypassed the flow of the plant during the construction of the aeration tanks and later became a part of the general scheme of the reconstructed plant. When work on the aeration tanks had progressed to the proper stage, the outside walls of the old tank adjacent to the new channel were removed, and the channel walls then became the exterior walls of the aeration tanks. Because of the topography of the site, only 700 cu.yd. of earth had to be removed to make way for the new construction. Demolition of old concrete amounted to 600 cu.yd.

Concrete Plant—Concrete was mixed at a central plant equipped with a Jaeger ¾-yd. mixer and was distributed to all parts of the job in small city-



KEY TRENCH AND DOWEL RODS, cast in place, assure strong bond between old concrete and new wall.

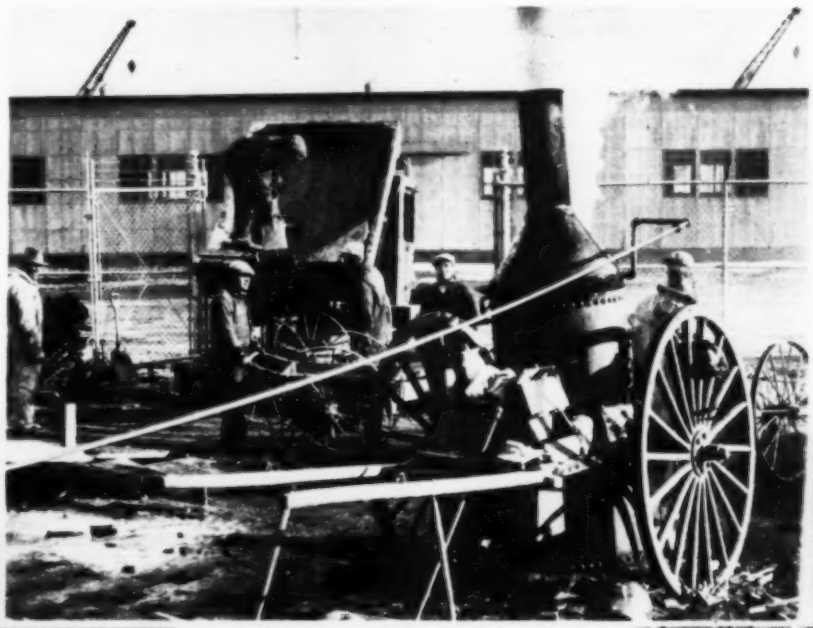
WOODEN FORMS are erected and securely braced to receive concrete for end wall by by-pass channel.



BYPASS CHANNEL is built to carry plant flow during construction and later to serve as end wall of tanks.

owned dump trucks. From the trucks the concrete was carried and dumped in the forms by buggies.

Mixing at a central plant simplified the heating of aggregates. A vertical 10-hp. tubular boiler owned by the Water Department and used ordinarily for thawing water mains in severe weather served to heat the aggregate at the central plant. The aggregates were piled on a steam pipe grill equipped with a bleeder for circulation.

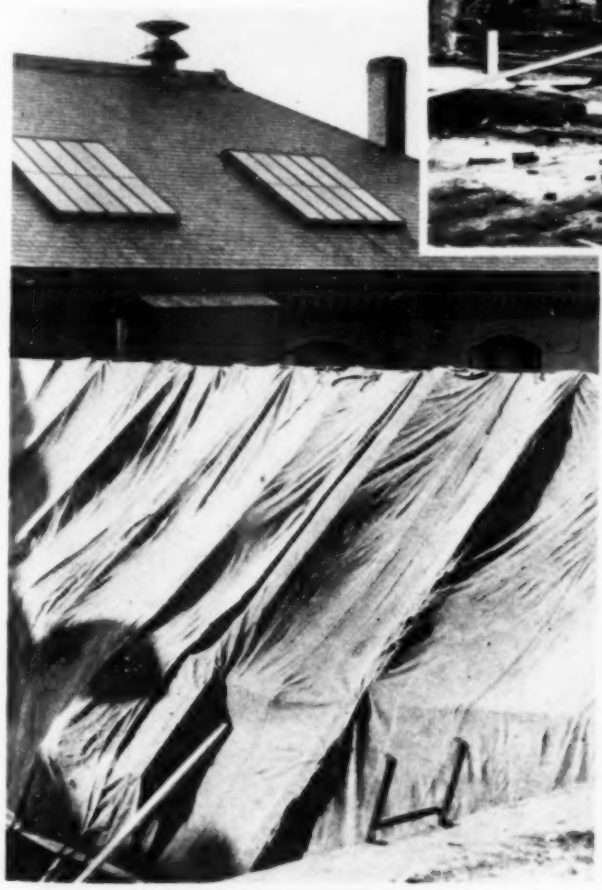


PORTABLE STEAM BOILER removes ice and snow from forms and provides moisture for curing concrete.

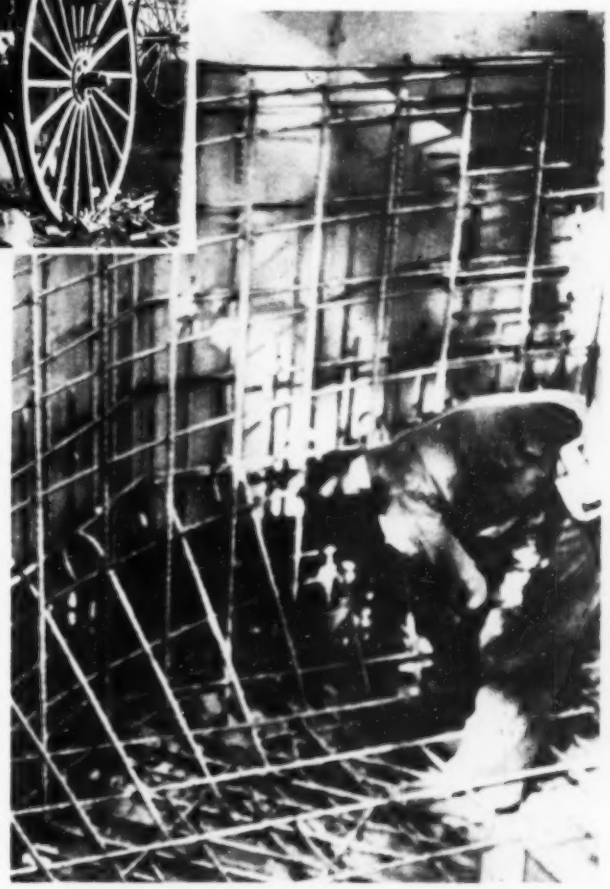
Most of the concrete structures consisted of thin walls and struts. The forms were protected with canvas housing which was maintained at a temperature of 50 deg. F. or higher by salamanders for 4 days following the placing of concrete. All forms were lined with composition board, which produced an excellent finish and which also aided to some extent in cold weather protection of the concrete. A small portable steam boiler from the city's sewer maintenance department was used to steam forms and to provide moisture for proper curing.

Administration—Engineering forces were organized by S. Frank Nolan, city engineer, from the staff in his office, under Frank E. Waterman, commissioner of public works, who also directed in a general way the organization of the construction personnel by Mr. Colver L. Saunders, superintendent of sewer maintenance. Preliminary experiments leading up to the remodeling of the plant were conducted by Julius W. Bugbee, plant superintendent.

Information contained in these notes was abtained principally from Mr. Waterman. The accompanying photographs were supplied by J. M. Duffy, district manager at Providence for the Hedge & Mattheis Co., of Boston, Mass.



CONCRETE WALLS AND STRUTS are protected after pouring by canvas housing heated with salamanders distributed along forms.



COMPOSITION BOARD used to line forms possesses insulating qualities which conserve heat in freshly poured concrete.

Step-by-Step Field Methods

Raised-Edge Curb for Concrete Pavement

Photos From

E. M. TURNER

Assistant State Highway Engineer, Nashville, Tenn.

1 HALF-BARRELS are placed at intervals just outside of pavement forms to hold concrete for raised-edge curb construction.

2 STEEL FORMS for raised-edge curb, 3 in. high, are clamped to tops of regular paving forms.

AS AN AID in reducing maintenance costs for shoulder work, concrete pavement with raised-edge curbs is being constructed by the Tennessee Department of Highways and Public Works. The accompanying photographs illustrate the various steps involved in raised-edge construction in Shelby County, as practiced by the Ziegler Construction Co., of Nashville, Tenn.

As outlined by C. R. Moser, resident engineer, the sequence of operations in building the raised-edge curb is as follows: Concrete for the curbs is shoveled into half-barrels placed just outside the forms for the main slab and spaced at distances of about 25 ft. on both sides. Metal curb forms, 3 in. high, are clamped on top of the regular pavement forms and concrete, deposited against them, is first compacted by a

3 WOODEN FLOAT is employed first to spread and compact curb concrete against 3-in. high forms.

4 SHAPING OF CURB is done with specially curved steel trowel.

5 BRUSH is applied to equalize surface texture of curb and main pavement slab.

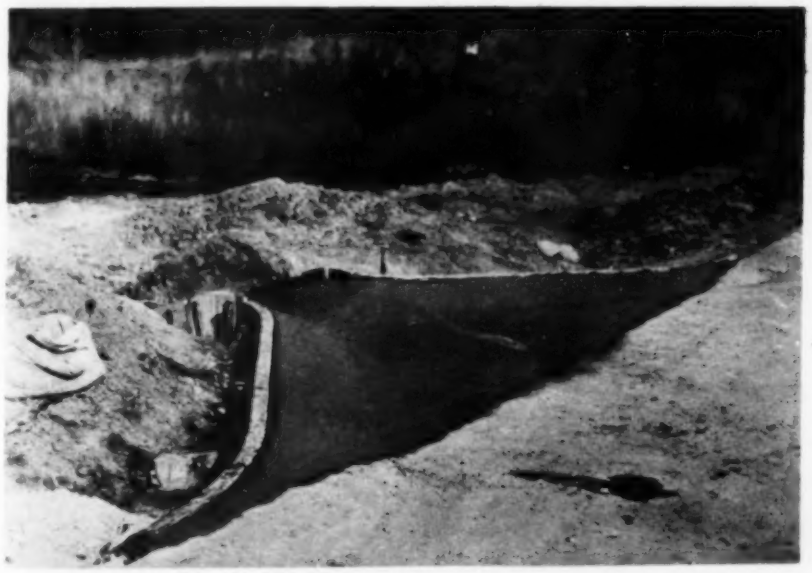
6 SMALL STEEL PLATE provides joints in curb corresponding to joints in pavement.

7 SPILLWAY OPENINGS in curb are carefully formed with aid of wooden templates.

8 SLIGHT DEPRESSION in pavement at spillway opening is formed to accelerate flow of water.

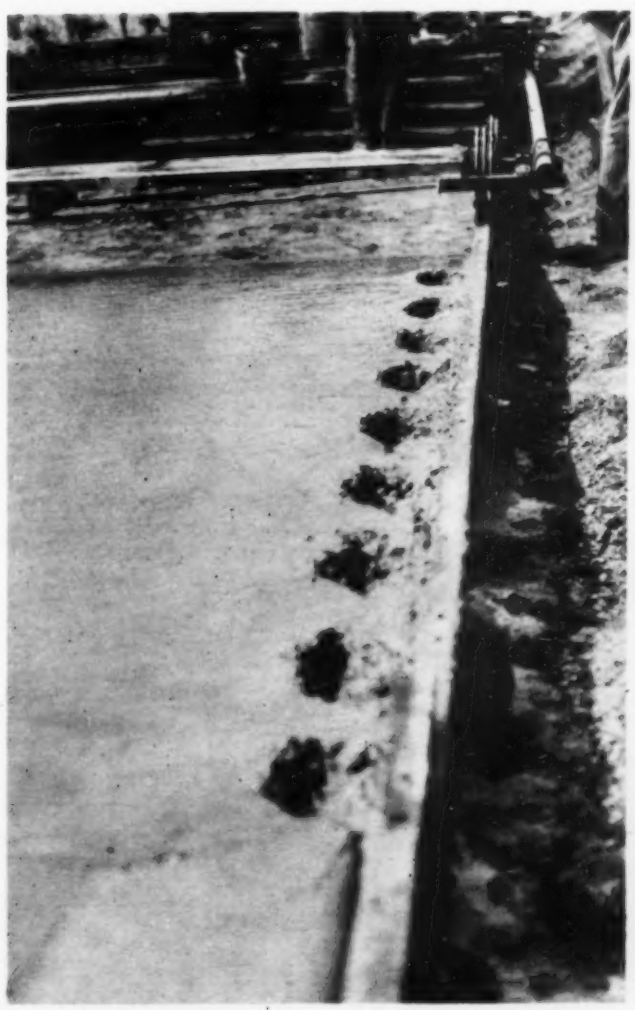
small wood float and then shaped with a curb-shaped trowel. The curb concrete is then brushed until the surface texture is the same as that of the main slab. A small steel plate is used to provide joints in the curb corresponding to joints in the pavement.

For purposes of drainage, spillway openings are provided in the curb and the pavement is slightly depressed to accelerate the flow of water. A length of about 12 ft. of curb is omitted at the end of each day's run of pavement to provide space on the forms for the finishing machine to start operations the next day.



9 SPILLWAY CONSTRUCTION, showing junction between depressed section of pavement and outlet.

10 COMPLETED SPILLWAY, showing opening into which water from pavement is drained off.



11 TO PROVIDE BOND at end of day's work holes are made in concrete pavement along line of raised-edge curb to be placed next day.

Old Pavement Salvaged With Non-Skid Surface

By WILLARD S. CONLON

City Engineer, Stamford, Conn.

STREETS ARE NOT UNLIKE public utilities; they are not really permanent in the true sense of the word. They require maintenance, rebuilding and, in some cases, relocation in the interest of economy. The original pavements, after having been in service for many years, can often be salvaged by low cost reconstruction, if done at the proper time. Many pavements, owing to wear or disintegration, are in such condition that light maintenance repairs fail to keep up with the destructive forces of traffic and the elements. However, the original investment in the old pavement may be conserved if careful judgment is used in consideration of the problem.

Resurfacing—There are many streets in the City of Stamford, Conn., on which thousands of dollars of the taxpayers' money can be saved if the right type of resurfacing is considered and installed at the proper time. As an illustration of the economies attainable in the utilization of the existing pavement—conditions permitting—it was decided to resurface an old wood block pavement. This pavement is on Hawthorne St., extending from East Main St. (Boston Post Road) to Elm St., and was built in 1912-13. It had dried out to such an extent as to render travel over it in wet weather extremely hazardous. In fact, it was necessary to detail a maintenance crew to spread sand in damp as well as wet weather.

A low-cost, high-type, non-skid, light wearing surface, ½ in. thick was constructed with local labor to overcome the hazardous condition and also to salvage the old pavement, using Bitumuls, a quick breaking emulsified asphalt, and trap rock. The asphalt was applied by the distributor illustrated in *Construction Methods*, for October, 1933, p. 38. The light wearing surface was placed in two courses, involving two distinct operations, as follows:

A tack coat of Bitumuls was applied at the rate of 1/3 gal. per sq.yd. This was covered with 12 lb. per sq.yd. of ½ in. trap rock and rolled once, after which another application of asphal was made of a light ½ gal. per sq.yd. and covered with ½-in. trap rock. Care was exercised in the broadcasting and even distribution of the rock, which was rolled with a power roller.

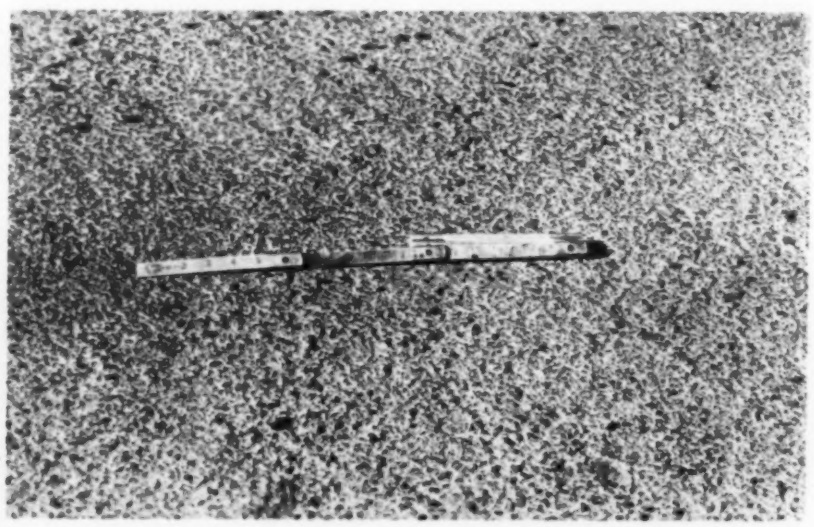
The resulting surface is a natural stone color, uniform in appearance, mosaic in texture, giving a non-skid surface. The asphalt adhered readily to the old pavement, waterproofed it and, with the stone, added certain value as a shock absorber between the load and the base.

Cost—The cost of the newly completed surface was $0.32 per sq.yd. It is highly probable that this cost could be reduced on a similar project in the light of the experience gained on this job.

By placing this light wearing surface upon a 20-year old pavement, we have obtained admirable results as noted herewith: (1) A profitable solution, in part, of the unemployment problem; (2) an excellent surface which gives every evidence of satisfactory service; (3) elimination of a traffic hazard; (4) an example of the economies that may be effected in using this type of reconstruction.

APPLYING ASPHALTIC EMULSION at rate of ½ gal. per square yard as second course on top of tack coat covered with ½-in. trap rock.

DISTRIBUTING NOZZLE is operated by hand to apply asphaltic emulsion, upon which top course of ½-in. trap rock is evenly spread



TEXTURE of finished surface covering old wood block pavement is mosaic in appearance and possesses non-skid qualities.

TRAILER EJECTOR on rubber-tired wheels is moved by hooking on to truck.

Present and Accounted For —

A Page of Personalities

CODE SECRETARY—E. J. Harding, managing director of the Associated General Contractors of America, Washington, D. C., has been appointed secretary of the newly organized General Contractors' Divisional Code Authority under NRA.

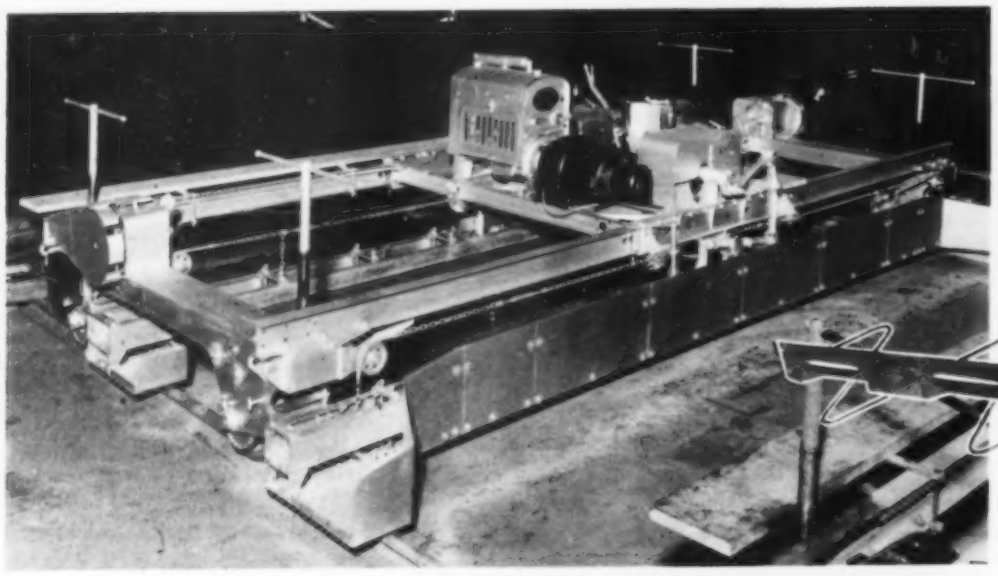
STATE HIGHWAY ENGINEER—E. E. Parker has been named state highway engineer of Wisconsin to fill the vacancy caused by the death of John T. Donaghey. Mr. Parker is a graduate of the University of Wisconsin, where he served as instructor in structural engineering before entering upon a 21-year term of office as city engineer of Madison. Later he was appointed resident representative at San Diego, Cal., for the Emergency Fleet Corporation's concrete shipyard.

CODE AUTHORITY MEMBER. E. T. Foley, of Foley Bros., Inc., St. Paul, Minn., is a member of the General Contractor's Divisional Code Authority, as announced in last month's issue. With the West Slope Construction Co., made up of several contracting companies, he is at present engaged in building San Gabriel dam No. 1 in California.

TUNNEL BUILDER—H. Leslie Myer, member of the firm of Silas Mason Co., Inc., general contractor, of New York City, has been selected to direct construction on that organization's $7,300,000 contract for the diversion tunnels at Fort Peck dam on the Missouri River. near Glasgow, Montana. The work includes four concrete-lined tunnels, each a mile or more in length and with finished inside diameters of 28 ft. The earth dam will be the world's largest hydraulic fill structure with a height of about 230 ft., a length of about 9,000 ft. and a volume of 75,000,000 cu.yd. For the Silas Mason Co. Mr. Myer was in charge of the recently completed subaqueous vehicular tunnel at Boston, Mass., a compressed air job on which he developed and used successfully a plan of removing muck by belt conveyors passing through air locks. Among other notable works on which he has served were the foundations for the George Washington bridge with a 3,500-ft. suspension span across the Hudson River, New York.

TENNESSEE VALLEY AUTHORITY PERSONNEL and consultants on tour of inspection of Norris Dam. *(Left to right)* L. F. Harza, consulting engineer, Chicago; C. A. Bock, director of engineering, T.V.A.; J. L. Savage, chief designing engineer, U. S. Bureau of Reclamation; S. M. Woodward, head, department of hydraulic engineering, University of Iowa; Ross White, construction superintendent, T.V.A.; C. H. Paul, consulting engineer, Dayton, Ohio; F. W. Scheidenhelm, consulting engineer, New York; Dr. C. P. Berkey, consulting geologist, New York; Barton M. Jones, construction engineer, T.V.A.; Arthur E. Morgan, chairman of the board, T.V.A.

NEW EQUIPMENT ON THE JOB



GAS-ELECTRIC FINISHER (*left*) for concrete and bituminous paving is claimed to have following advantages: (1) Faster forward and reverse motion; (2) less time necessary to change machine widths; (3) faster in crown adjustment and equipped with redesigned and simplified electrically operated screeds; (4) greater traction for handling heavier loads and drier concrete; (5) finger touch control; (6) designed for addition of vibrating attachments, tamper and accessories for bituminous paving.—Blaw-Knox Co., Pittsburgh, Pa.

METAL-LACED JOINT for reinforcement of concrete roads consists of vertical plate through which is threaded zig-zag steel rod. Plate is shaped to provide slab interlock or transfer of load vertically and reinforces slabs for 10 in. along adjoining sides. Rod "laces" slabs together. No stakes or supports are required. Produced in standard 10-ft. units, with a variety of rod diameters, plate widths and gages. Designs available for both longitudinal and transverse joints.—A. O. Smith Corp., Milwaukee, Wis.

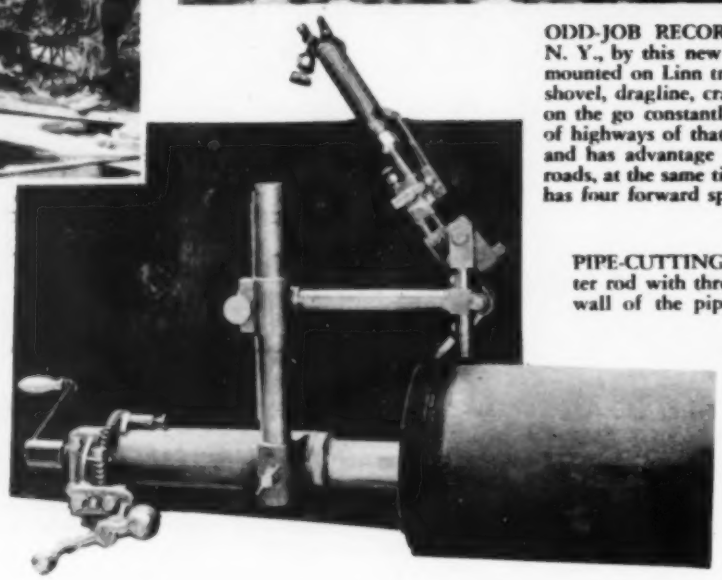
If You Want Further Information—

Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.

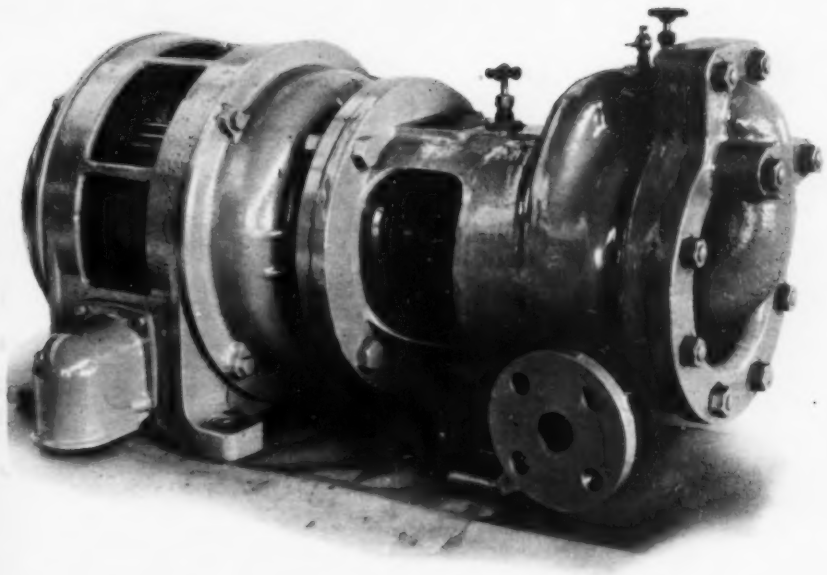
IMPROVED-TYPE WAGON DRILL for drilling deep blast holes in quarries and general rock excavation. Incorporates adjustable drill steel centralizer, for reducing time and labor in collaring drill holes. Leveling device permits adjustment of drill tower to vertical position when drill is set on uneven ground, thus eliminating blocking up of wheels. Furnished either with air hoist or hand winch, and with three or four wheels. Drilling engine supplied either for light or heavy, wet or dry drilling.—Worthington Pump and Machinery Co., Harrison, N. J.

ODD-JOB RECORD has been earned in Schoharie County, N. Y., by this new ½-cu. yd. model P&H multi-purpose shovel mounted on Linn truck chassis: Because it can be equipped with shovel, dragline, crane or hoe to handle every type of job, it is on the go constantly, according to L. J. Wright, superintendent of highways of that district. It gets from place to place quickly and has advantage of decreasing ground pressure on improved roads, at the same time providing certain positive traction. Truck has four forward speeds and one reverse.—Harnischfeger Corp., Milwaukee, Wis.



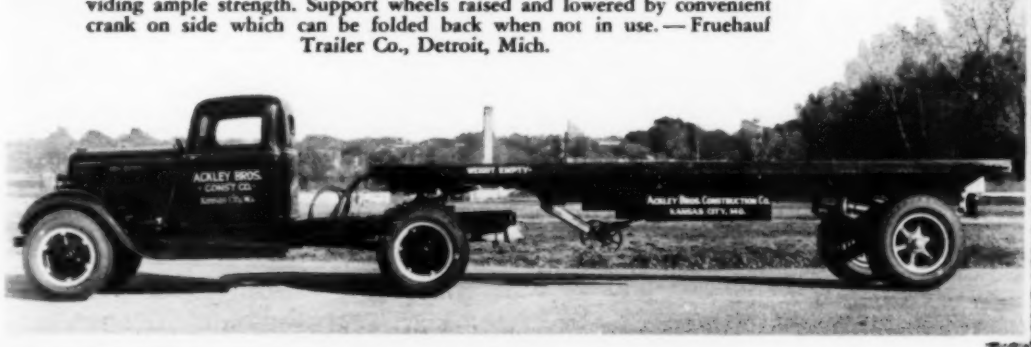
PIPE-CUTTING AND BEVELING MACHINE consists of center rod with three spreading arms which press against the inner wall of the pipe, holding it in position with arm supporting blowpipe that can be adjusted to desired angle of cut. Blowpipe and arm rotate without use of crank for quick centering of device and by means of crank when doing actual cutting. Will take almost any hand cutting blowpipe, is readily portable and simple to operate.—Linde Air Products Co., 30 E. 42nd St., New York City.

FOR SPEEDY, NIMBLE OPERATION in cramped quarters this service ditcher has been designed to dig laterals or other small trench up to 22 in. in width and 5½ ft. deep. Under favorable conditions unit will dig smaller sizes of shallow trench at speeds up to 27 ft. per minute and at slower digging speeds will cut way easily through difficult soils. Available in three different bucket widths, cutting trench 11½ to 14½ in., 14½ to 18 in., and 18 to 22 in. Overall width of machine, 52 in. Buckets for either rounding or square-bottom ditch. — Buckeye Tractor Ditcher Co., Findlay, Ohio.



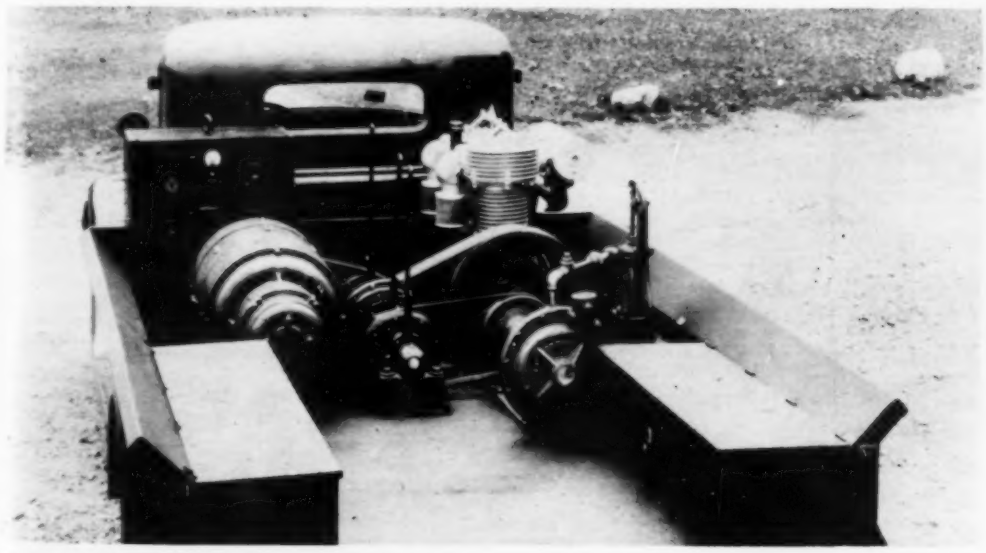
TWO-STAGE MOTOR PUMP designed for service where higher heads are encountered than can be handled by single-stage unit. Can handle up to 125 g.p.m. against heads of 450 ft. Single shaft carries pump impellers and rotor of motor, eliminating need of coupling and making necessary only two bearings. Impellers of single suction type are placed back to back and can be inspected or removed without disturbing piping. Units do not require special foundation and may be mounted in vertical position, if desired. Other sizes of Cameron Motor pumps range from ¼ to 30 hp. and in capacities from 5 to 1,000 g.p.m.—Ingersoll-Rand Co., Phillipsburg, N. J.

PLATFORM-BED 7-TON SEMI-TRAILER (*below*) powered by Dodge 2-ton tractor truck is used by Ackley Bros. Construction Co., Kansas City., Mo. to move crawler tractors, road graders and other heavy units. Frame is 5 in. deep at front and 7 in. at rear end where bending stresses are slight. Where loads are concentrated, frame tapers to depth of 9⅝ in., thus providing ample strength. Support wheels raised and lowered by convenient crank on side which can be folded back when not in use. — Fruehauf Trailer Co., Detroit, Mich.



OIL ENGINE TRACTOR pulls 12-yd. wagon on Forcum-James Construction Co.'s job near Memphis, Tenn. Designed to burn any diesel fuel within limits of viscosity, free from sulphur and clean. Because of low compression of engine (125 lb.) starts either by hand or electric starter. Fuel oil injected into cylinders under pressure through Bosch diesel pump and injectors. Ignition by spark plug and magneto. Two models develop 48 and 76 draw bar horsepower and weigh 23,000 and 11,200 lb. respectively. Equipped with front bumper, pull hook and 20-in. track shoes. — Allis-Chalmers, Milwaukee, Wis.

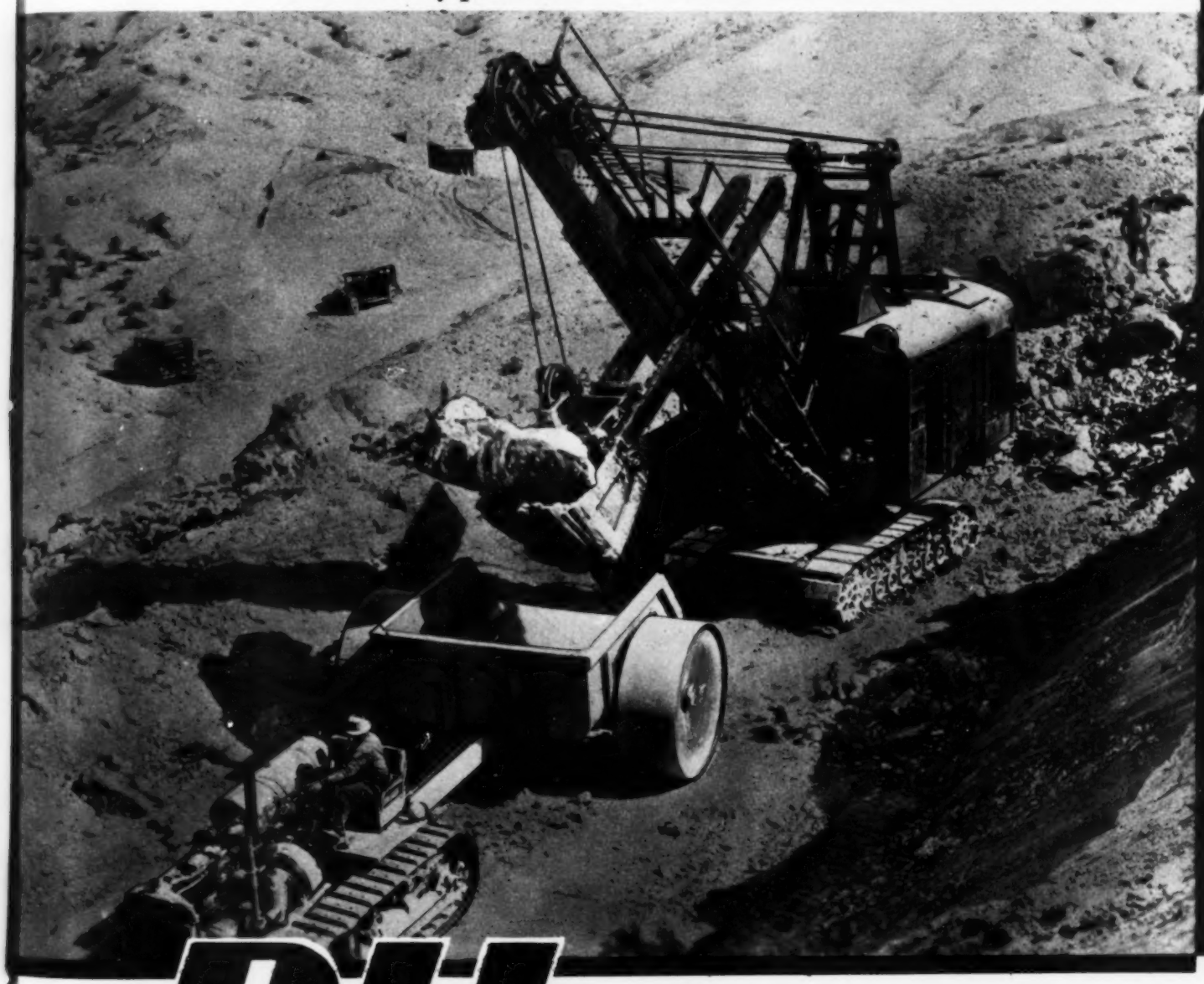
TRUCK-MOUNTED welding generator-compressor unit (*below*) combines 40-v., 200 or 300 amp., shunt inductor-type welding generator and 140-, 160-, or 240-cu. ft. Davey air compressor operating through power take-off on any 1½ ton (or smaller) truck whose engine speed is 1,800 r.p.m., and engine displacement 215 cu. in., or better. Universal welding generator is interlocked through Ditwiler power take-off with engine governor to hold welding generator at a constant speed under loads. Truck can be moved under own power after power take-off has been disengaged.—Developed through cooperation of Universal Power Corp., 1719 Clarkstone Rd., Cleveland, Ohio, and Ditwiler Mfg. Co., Galion, Ohio.



from jobs like this

comes the evidence to show how P&H shock absorbing construction cuts upkeep and boosts yardage • • • •

ON jobs that punish a shovel, any man will thank his lucky stars he stuck to a P & H. New type Split Second Control clutches absorb the shocks, minimize breakage, reduce upkeep. You can be sure of steady production — week in and week out — with a P & H.



HAVE you seen the way P&H Split Second Control works? Have you felt the way it smooths out shocks — how it speeds up digging cycles? We'll be glad to show you a P&H at work.

P&H

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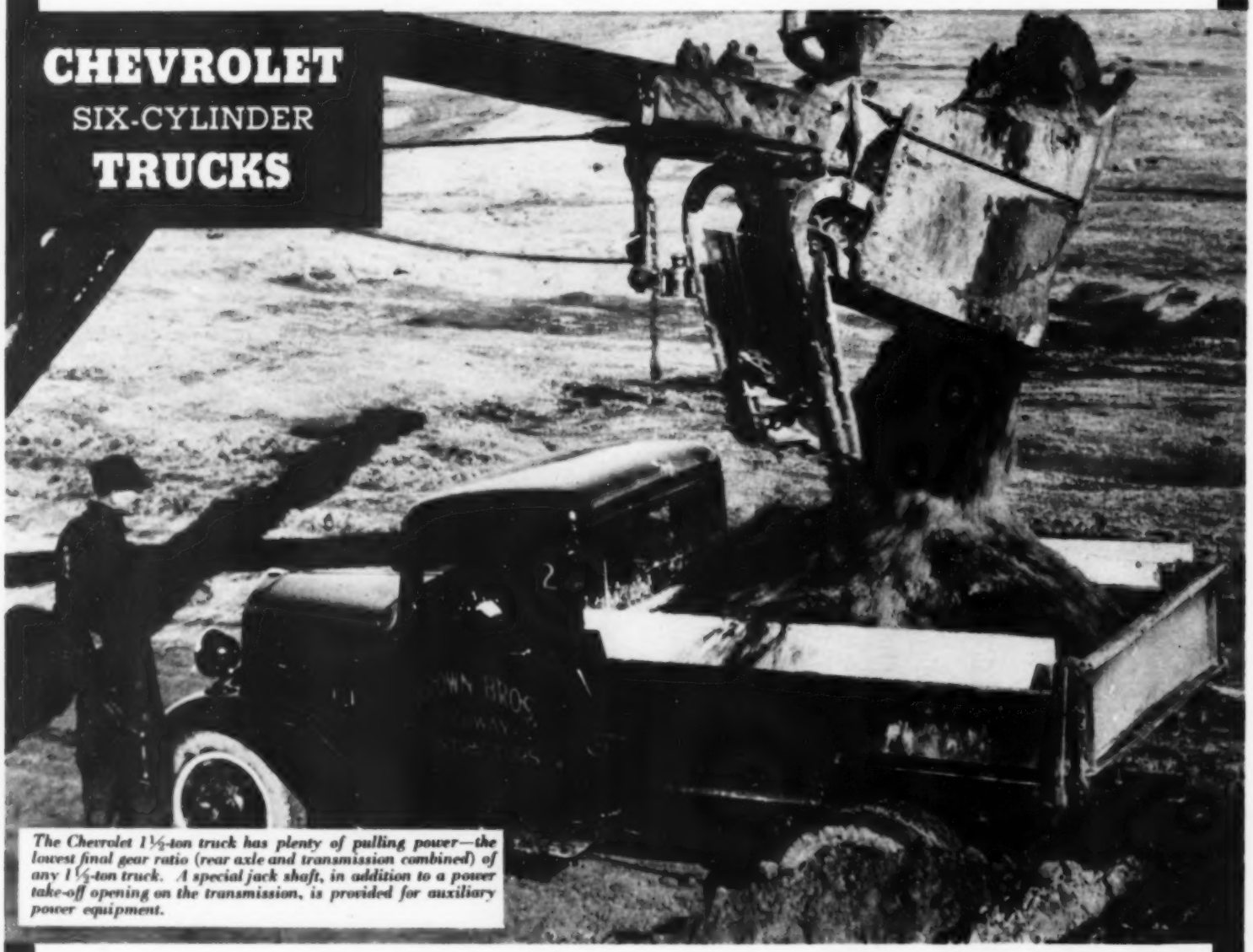
. . . the lowest-priced Six you can buy, and it's all truck throughout

CHEVROLET For construction hauling at lower cost, take a *Six* every time—and if it's a Six with *overhead valves*, you'll save even more. For only an *overhead valve* engine can give you Blue-Flame combustion, with its greater economy on gas and oil and lower upkeep cost. And only a *Six* gives you smooth, steady power without needless extra cylinders to maintain. The 1934 Chevrolet truck is a *Six*—and it also has *overhead valves*. Those two facts are all-important for economy. In addition, the Chevrolet truck is *all truck throughout*. You can load it to capacity and count on truck strength in every part—in the axles, springs, frame, transmission and brakes. Everything about the Chevrolet truck is bound to save you money on every job—and it's the *world's lowest-priced Six!*

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

Compare Chevrolet's low delivered prices and easy G.M.A.C. terms. A General Motors Value

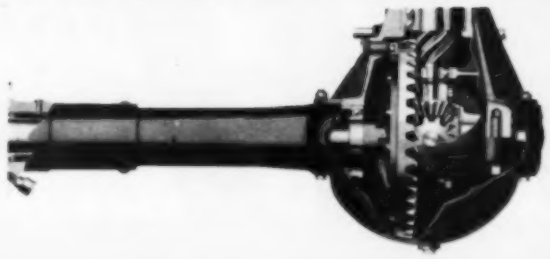
CHEVROLET
SIX-CYLINDER
TRUCKS



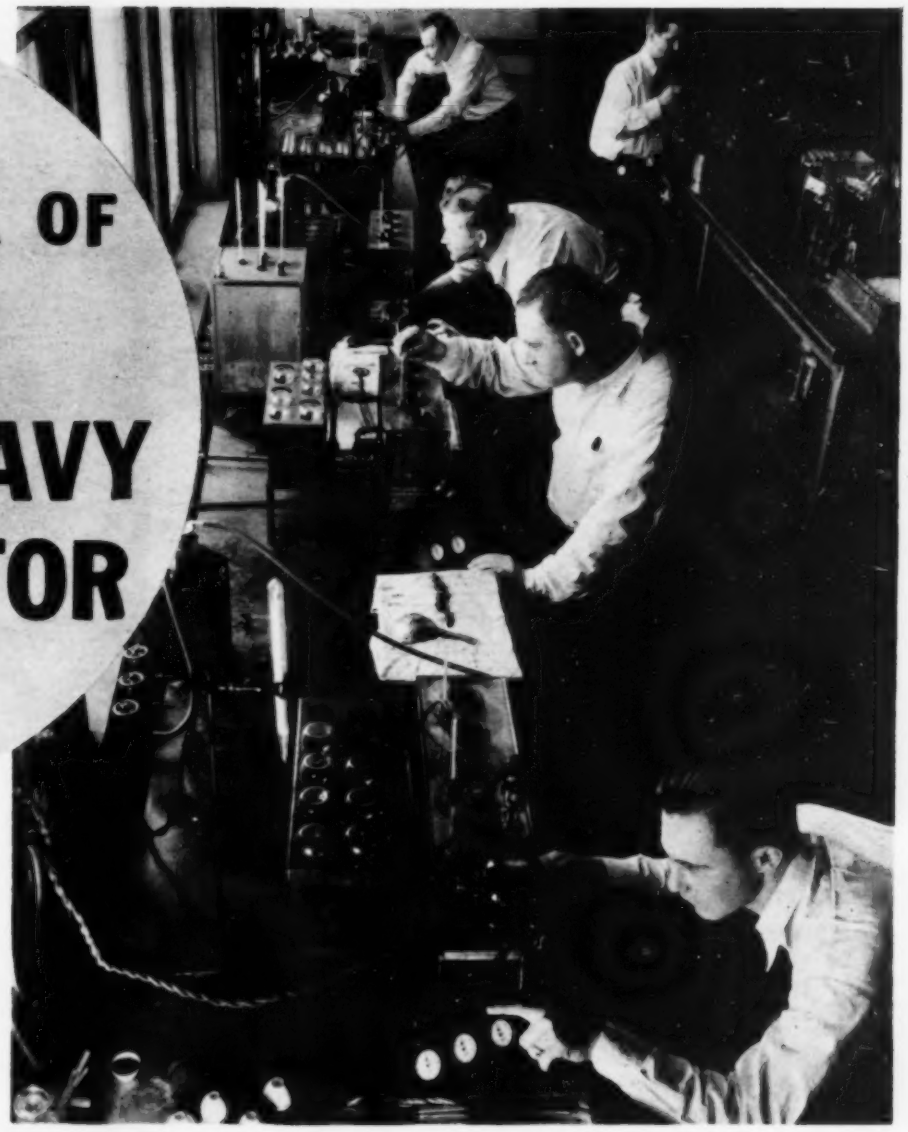
The Chevrolet 1½-ton truck has plenty of pulling power—the lowest final gear ratio (rear axle and transmission combined) of any 1½-ton truck. A special jack shaft, in addition to a power take-off opening on the transmission, is provided for auxiliary power equipment.

HEAVY DUTY REAR AXLE

Extra strength is built into the rear axle for heavy duty work. It has exceptionally big axle shafts, double-row wheel bearings, straddle-mounted pinion, 4-pinion differential, one-piece welded banjo-type housing with a big removable plate—in every way, an axle built for hard and dependable service.



20 OILS DO WORK OF 50 thanks to NAVY WORK-FACTOR TEST!



SINCLAIR ENGINEERS *at Sinclair's East Chicago Testing Laboratories at work determining the viscosities of various Sinclair lubricants. These tests supplement the work of the Navy Work-Factor machines.*

A few years ago one of the country's leading manufacturer's was buying 50 different oils and greases for his plant. Many different brands were included. Today this concern has reduced the number of oils used to 20 — and all of them are Sinclair lubricants!

This resulted in a 47.6% savings in lubrication costs. **The saving was due largely to the use of oils of high Work-Factor Test and of standardizing oils by viscosity, each oil being carefully fitted to its various uses.**

Sinclair has recently installed at its East Chicago Testing Laboratories the largest battery of Navy Work-Factor machines ever built for any company. By means of these machines Sinclair engineers can foretell to a scientific certainty how long an oil will stand up in any type of industrial or transportation equipment.

These are new developments in plant upkeep which you should know about. Clip the coupon below — it will bring you, free, WORK-FACTOR NEWS, a new lubrication journal which tells more about it.

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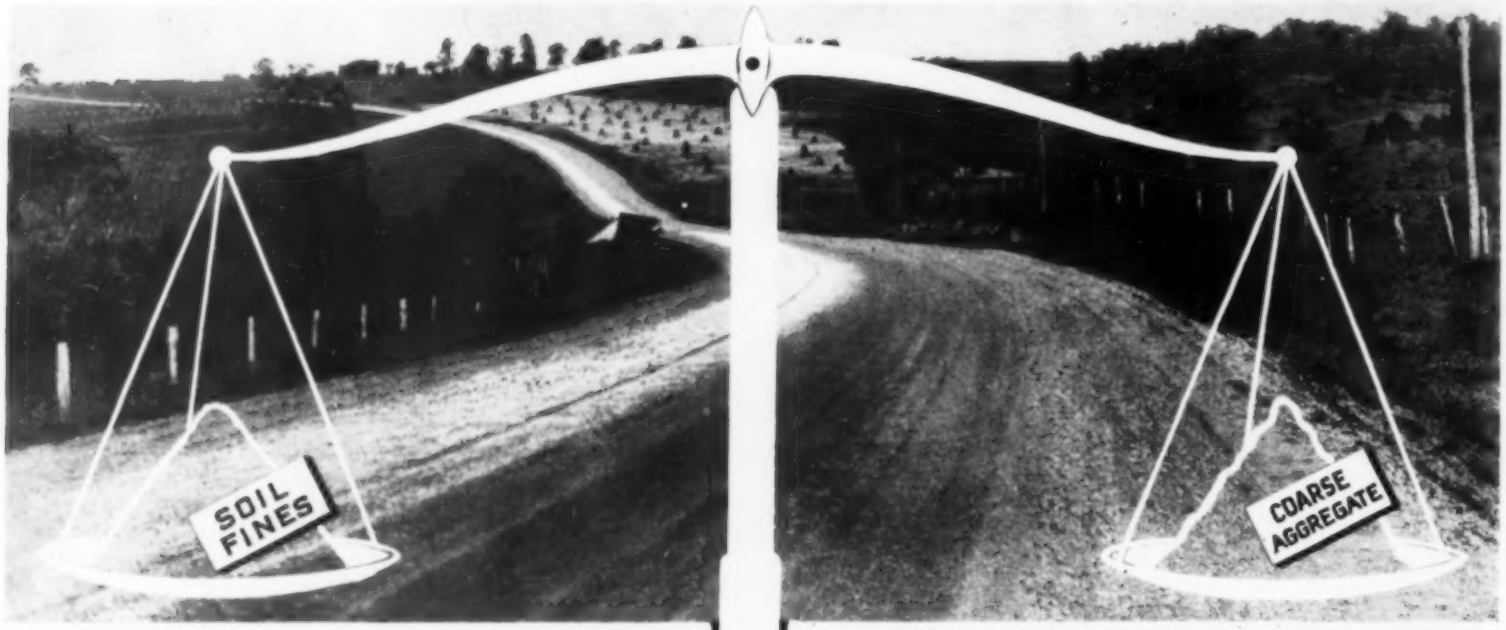
• LOW-COST ROADS •

scientifically designed for maximum stability by means of BALANCED soil composition



▲ This smooth, dustless, hard-surface road is built with "balanced" proportions of ordinary gravel (at approximately 50%) and soil fines (sand 30%, silt 10%, clay 10%). It is solidly compacted by traffic and bound by a retained moisture content controlled with Calcium Chloride. It is *good, STABLE all-weather* road constructed at but a fraction of the cost of the usual hard pavement. Maintenance expense is trivial. Blading and added material are required at only rare intervals.

▲ This soil road *(clay and silt)* is UNSTABLE because it lacks wear-taking gravel, slag or fine stone. Rain turns the materials into mud; sun dries them out; traffic plows them into deep ruts when soft, and crumbles them into dust when dry. Blading is of little value.

▲ This stone road is UNSTABLE because it lacks the bonding properties of moisture-retaining clay. Gravel remains loose and is ground to dust; traffic throws the materials aside. Frequent blading is necessary — and still the surface is unstable.

Balanced materials plus moisture supplied by Calcium Chloride — this is the key to low-cost hard-surface roads economically maintained. It is the road-building discovery of the age! Foremost U. S. Public Roads officials acclaim this "soil stabilization" method for secondary highway construction. A large and constantly increasing number of counties and smaller communities are using it. Many miles have already been laid — and have proved themselves the solution to the problem of maintaining highway systems with lean treasuries and benefiting a greater proportion of taxpayers.

Write for literature on "Calcium Chloride Stabilized Roads." Address any of the following members of the CALCIUM CHLORIDE ASSOCIATION:

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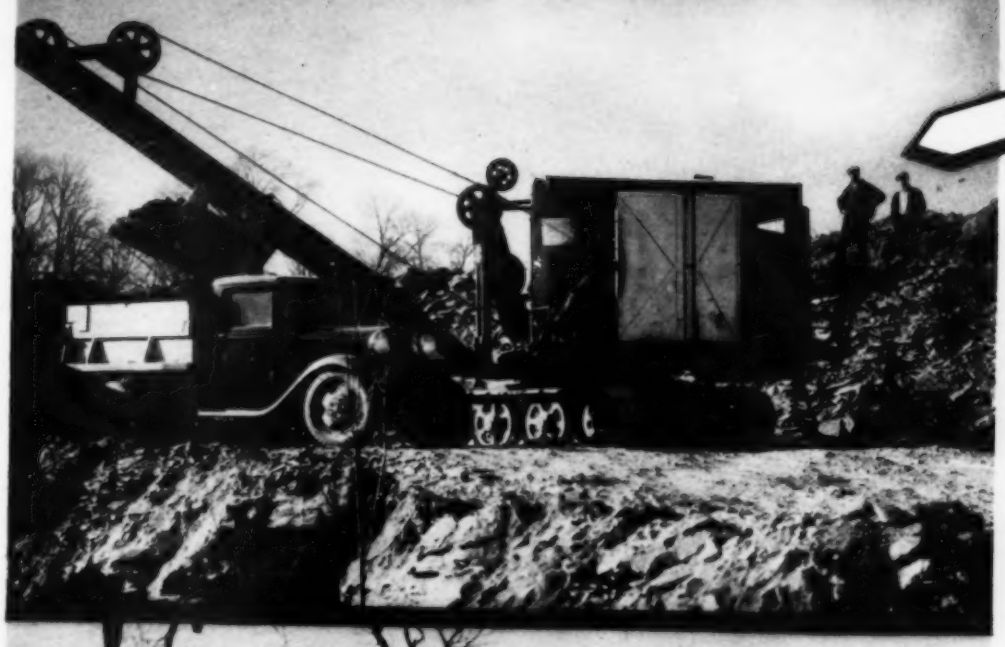
for stabilizing road surfaces

THE PLUNGER SHOVEL

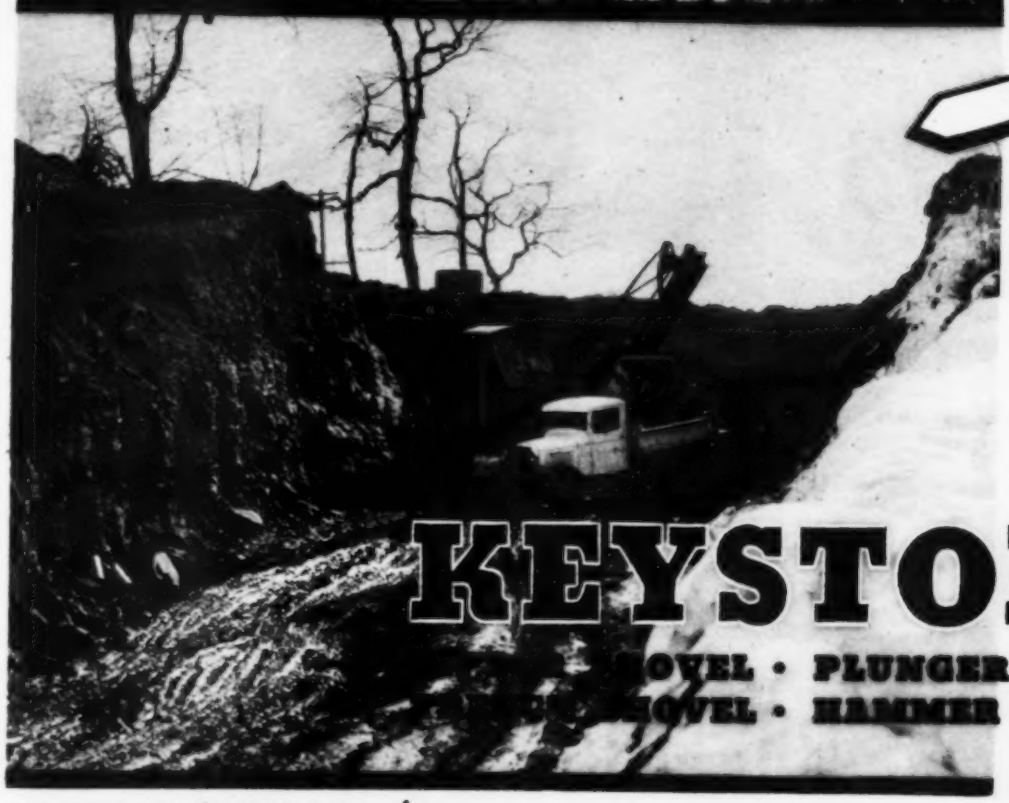
IN DEEP EARTH CUTS

"The shovel I would like to have," said a contractor, "is one which would have all the advantages of the Dipper in deep cuts combined with those of the Skimmer in light cuts, in trimming slopes, in accurate finishing of grade, and in breaking old pavements." . . . His wish has now been realized . . . the new full revolving Keystone Plunger Shovel does everything either shovel can do, and more. It is up to 100% faster than the dipper shovel in light cuts, and up to 15% faster in deep cuts.



STRATIFIED ROCK

The photos show a 1¼ cubic yard capacity Model 18 Plunger Shovel at work for Pennsylvania State Highway Department in Beaver County, Pa. No. 1 is typical of deep earth cuts made near Fombell. No. 2 shows it digging stratified rock for road base. No. 3 is a cut 23 feet deep, of solid, decomposed rock, extremely difficult digging. Here it averaged 400 cu. yds. per day. The plunger shows to best advantage in such hard digging because the hauling force on plunger bucket is uniformly high from beginning to end of bucket pass. In this it is distinctly superior to a dipper shovel. ¶In one hour, the Plunger Shovel may be converted into a Trench Shovel, Crane, or Demolition Hammer, without boom change.



DECOMPOSED ROCK

Keystone builds all types: The dipper shovel for those who want it, and the plunger shovel for those looking for new ways to cut costs. Our only object is to help you determine which type is most economical and efficient for the kind of work you have in mind. Our bulletin "Depth of Cuts in Highway Grading" shows valuable facts. This and other publications are yours for the asking. Keystone Driller Company, Beaver Falls, Pa. (Est. 1882). Branches, Arlington, N.J., Birmingham, Ala., Waukegan, Ill., and Joplin, Mo.

KEYSTONE 18

SHOVEL · PLUNGER SHOVEL
SHOVEL · HAMMER · CRANE

CHOSEN FOR SERVICE UNDER GOVERNMENT LEVEES

● *Installing a twin 60-inch Armco Paved Invert Pipe under a 30-foot high ring-levee in the south.*

As you can imagine, government engineers have to be unusually particular about the kind of pipe they put under levees. It must stand up 100%. For if the pipe fails in any manner, it is likely to cause devastating floods—tremendous losses of human life and property.

Faced with this responsibility, government engineers made a searching investigation of Armco Paved Invert Pipe. They pronounced it "ideally suited for the job." As a result, this strong, durable pipe is being used extensively under levees, in the government's great flood control program.

What better recommendation could you have for using Armco Paved Invert Pipe under your roads and streets—where the hazards of failure are not nearly so great? Call in an Armco drainage specialist today, or mail the coupon for complete information.

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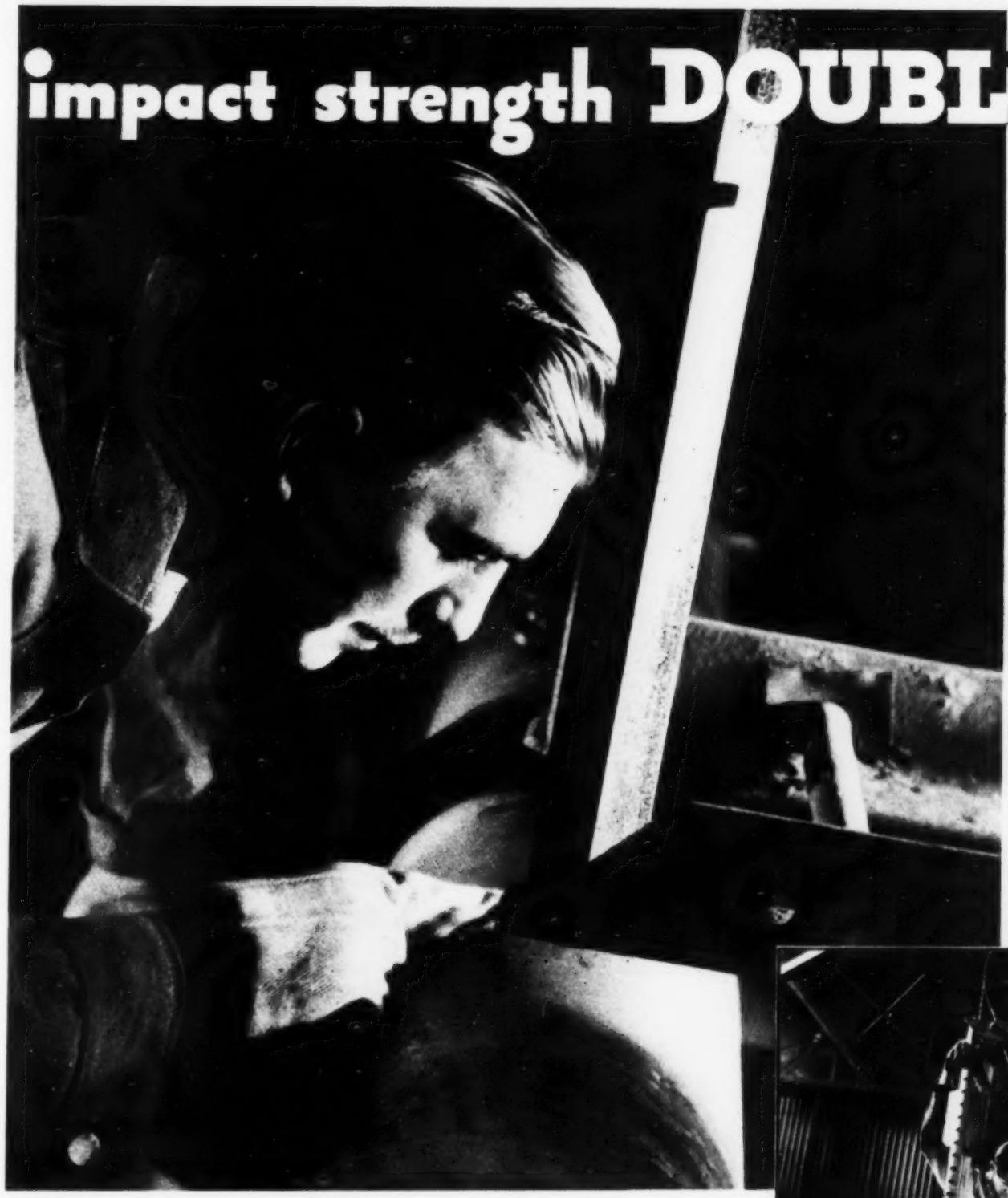
CM-5

impact strength DOUBLED



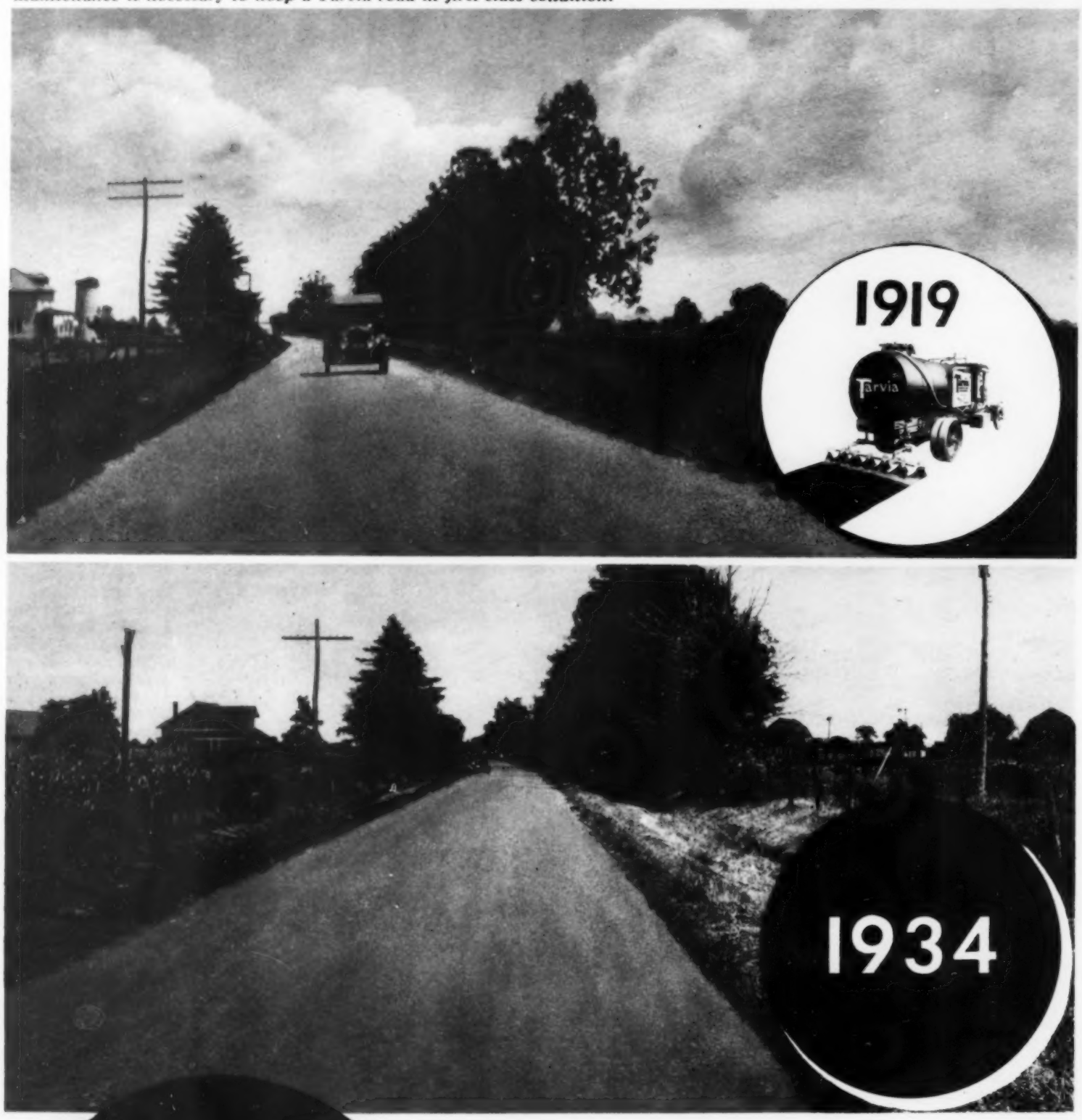
Photos show test to measure impact resistance of Super-de Lavaud Pipe while under internal hydraulic pressure of 65 pounds per square inch and submitted to blows from 50-pound hammer. Hundreds of such tests over a period of more than a year demonstrate that this new pipe is shatter-proofed to the extent that impact resistance has been increased more than 100 per cent.

The greatly increased impact resistance and the non-shattering characteristic of our new Super-de Lavaud Cast Iron Pipe are the result of a patented improved process of centrifugal casting and a patented annealing process. Super-de Lavaud Pipe is *cast without chill in a metal mold.* The process is a basic discovery producing a revolutionary metallurgical change. The product is *tougher;* capable of *greater deformation without breakage; does not shatter* when tested to destruction by hydrostatic pressure. Impact resistance is *more than doubled* giving maximum protection from plant to underground. Send for descriptive booklet.

UNITED STATES PIPE AND FOUNDRY CO., BURLINGTON, N.J.
Foundries and Sales Offices throughout the United States

U.S. SUPER-DE LAVAUD PIPE

Stewart Road, Monroe County, Michigan, maintained with Tarvia since 1919, the year of the first successful transatlantic aeroplane flight. Top photo was taken in 1921; lower photo shows the same road today. Only the simplest, most inexpensive maintenance is necessary to keep a Tarvia road in first-class condition.



Barrett
Tarvia
GOOD ROADS AT LOW COST

TARVIA penetrates deeply into the road-bed and effectively binds the aggregate. This means that surface stone or gravel is held firmly in place, so as to provide a smooth, easy-riding, lastingly skid-safe road. With Tarvia, existing roads can be put in first-class shape—quickly, cheaply—and kept that way indefinitely. The Tarvia field man will gladly suggest simple, inexpensive repair and maintenance methods that will protect your investment in existing roads.

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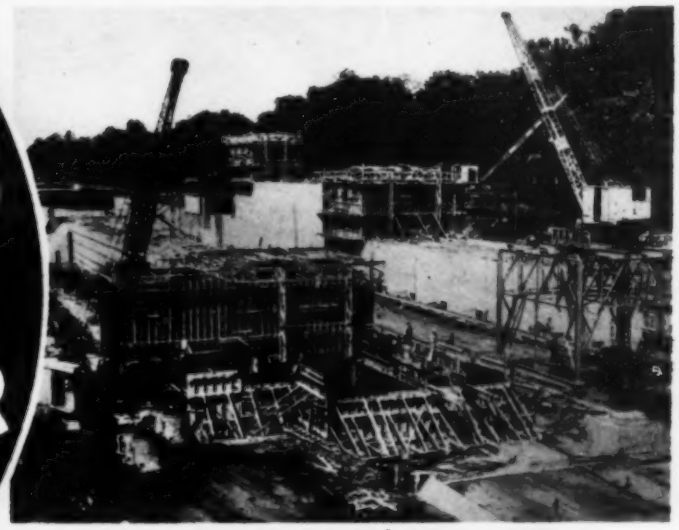
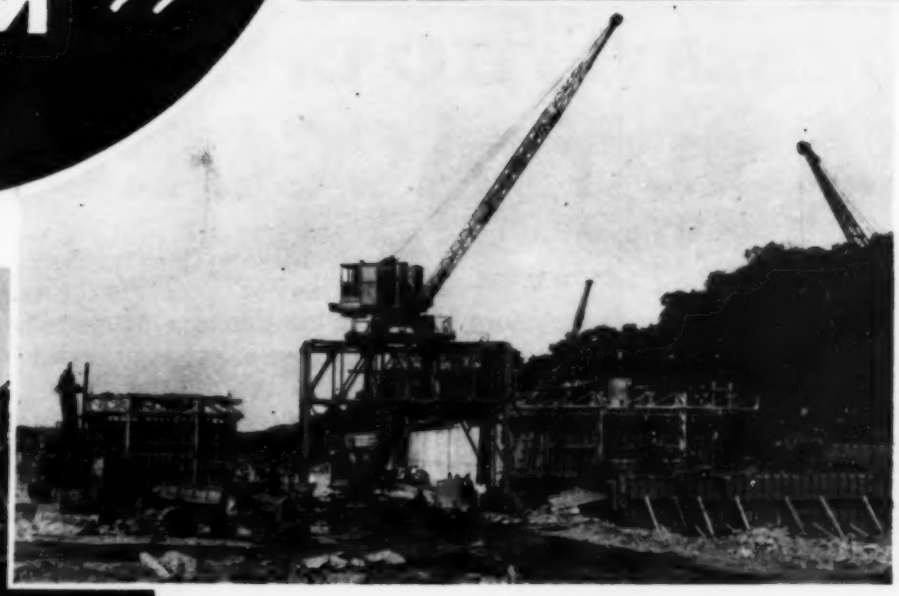
KOEHRING

5 KOEHRINGS on the Lock at General JOE WHEELER DAM





The ability of the Koehring Crane to peak the boom and load, while swinging or traveling, was a great time-saver on this work.

Koehring Shovels and Draglines used for excavation, and Koehring Cranes for handling forms and concrete.

SPEED, power and uninterrupted service were required and expected from equipment, by the Miller-Hutchinson Company, builders of the lock at the General Joe Wheeler Dam. For this reason they installed five Koehring Shovels, Cranes and Draglines on this job.

Contractors, having time limit jobs, know that dependable equipment is essential for continuous operation. Koehring Shovels, Cranes and Draglines are helping contractors to solve the problems of low-cost operation.

Investigate Koehring — let us tell you about the many superior operating features and Heavy Duty Construction of Koehring equipment.

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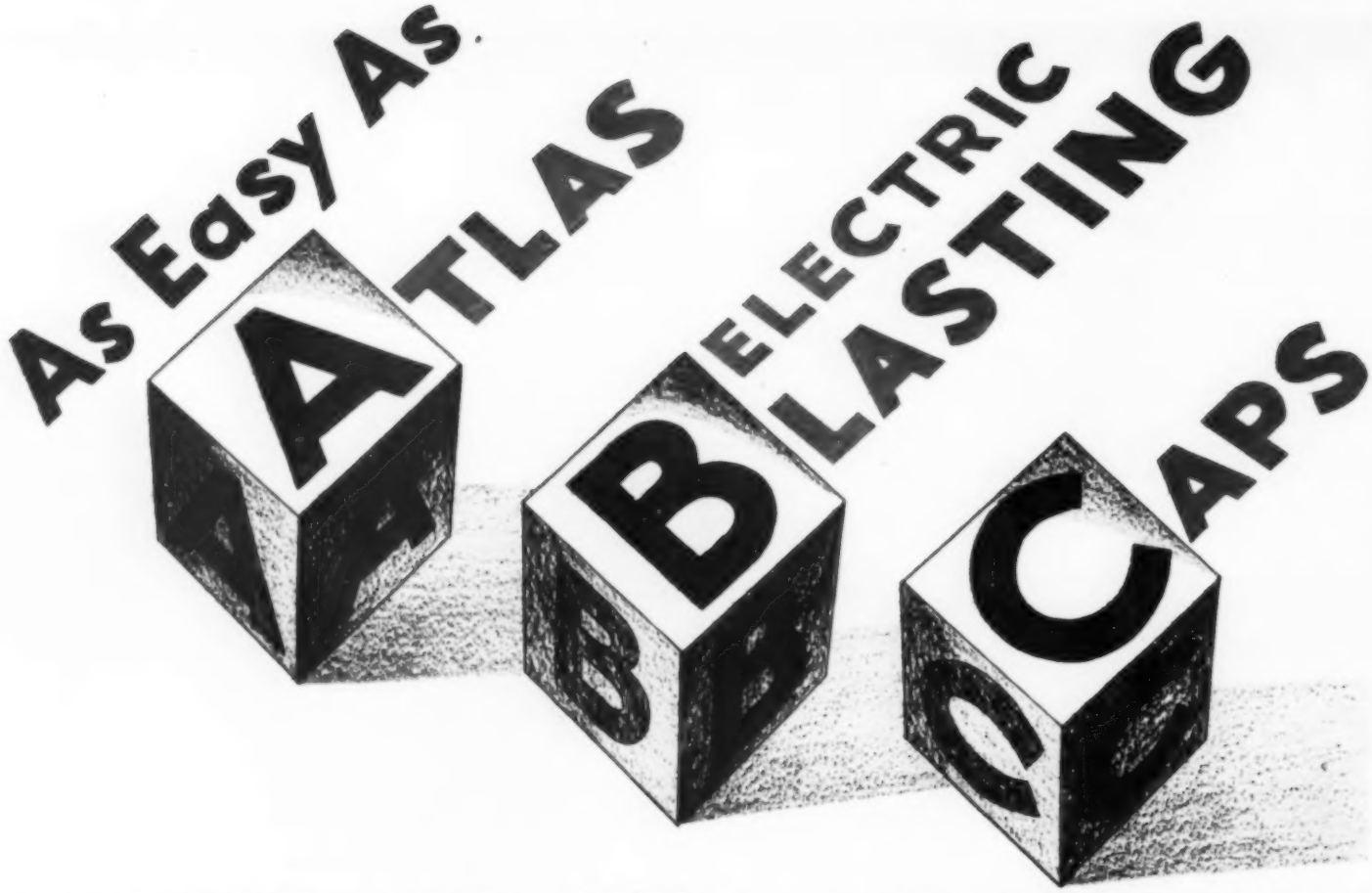
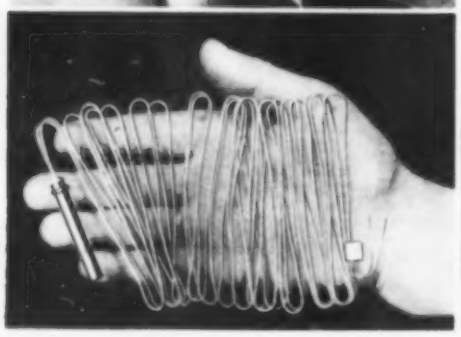
MILWAUKEE *Division of National Equipment Corporation* WISCONSIN



TO CARRY . . . TO OPEN . . . TO PRIME IN THE HANDY ACCORDION FOLD



Electric Blasting Caps reach a new high point in convenience and safety through the development of the Atlas Accordion Fold package. Its advantages are tremendous wherever the practical man uses electric firing.

The utmost safety is provided by folding the wires accordion-wise to cushion and protect the electric blasting caps at the sides and ends.

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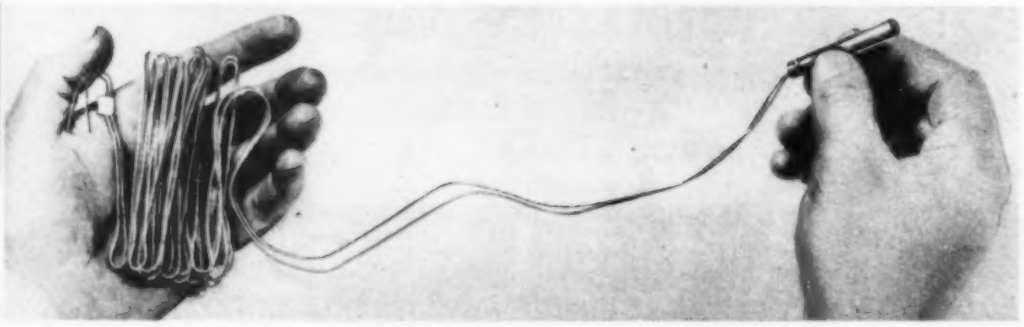

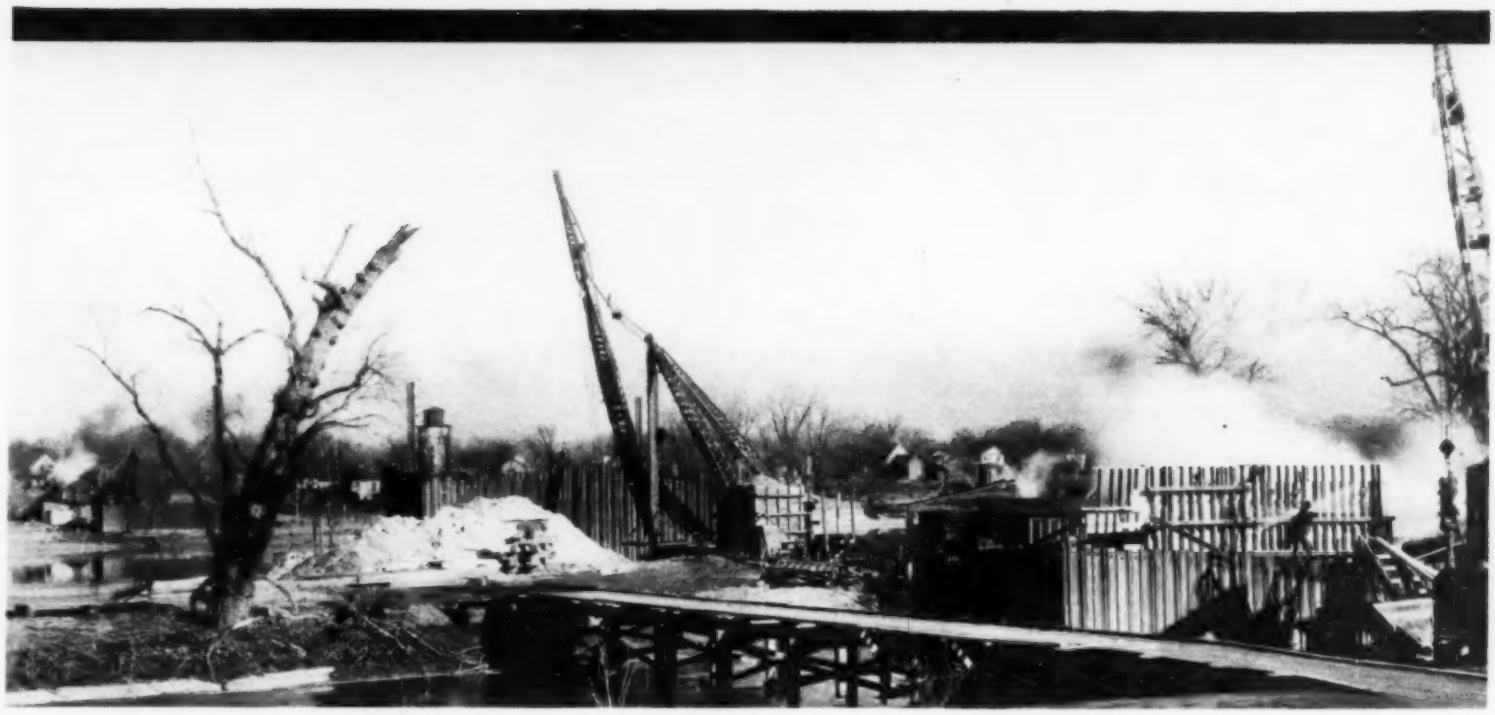

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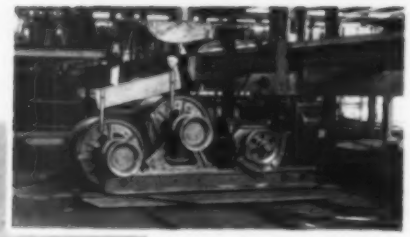

BUILDING A NEW POST OFFICE at Cleveland, Ohio. To assure speedy work at low cost, G-E motors and control were selected for these large cranes. The close-up shows one of the units in operation.

For Speedy Work at Low Cost....

USE THE RIGHT MOTOR AND THE RIGHT CONTROL

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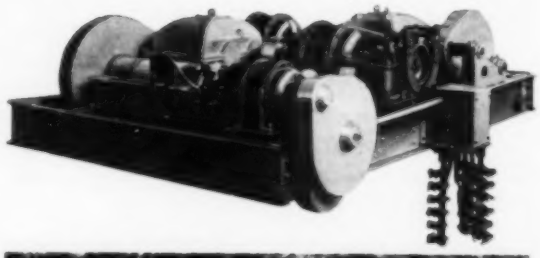
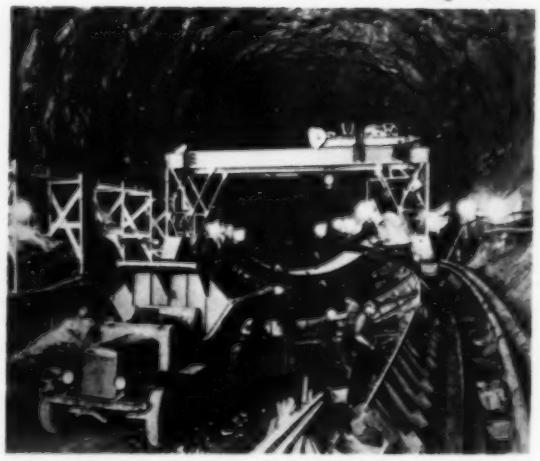
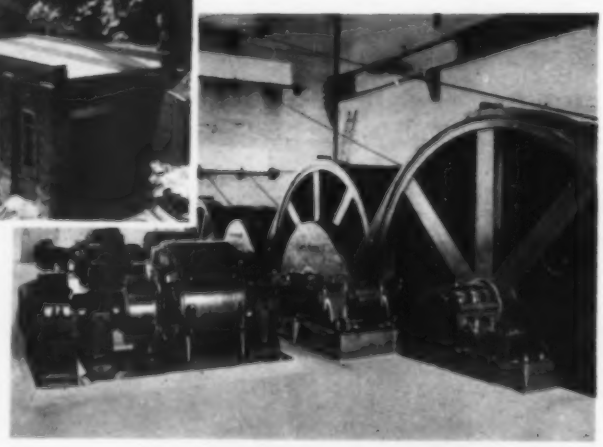




CONSTRUCTION OF THE CONCRETE LINING of the Boulder Dam diversion tunnels was rushed at the rate of 2300 cubic yards of concrete a day with this G-E equipped gantry crane.

WORLD'S LARGEST CABLEWAY, at Boulder Dam, is equipped with G-E motors, control, and Thrustor brakes for speedy, economical, and safe operation. The three hoists shown at the right are driven by two 175-hp. and one 275-hp. G-E motors.



MOST POWERFUL DREDGE—The "Marshall C. Harris" saves power by the use of G-E motors and a G-E Scherbius speed-control unit.

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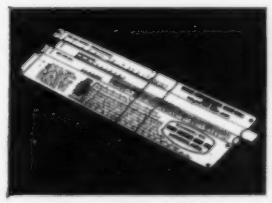

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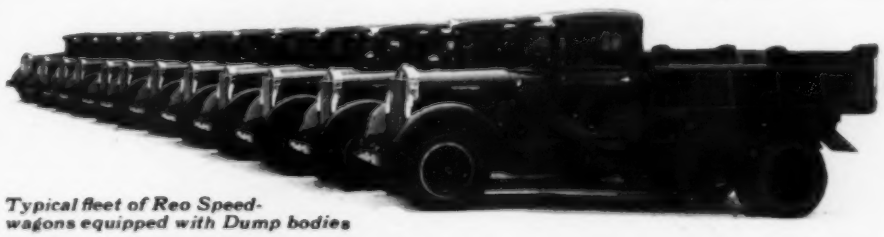

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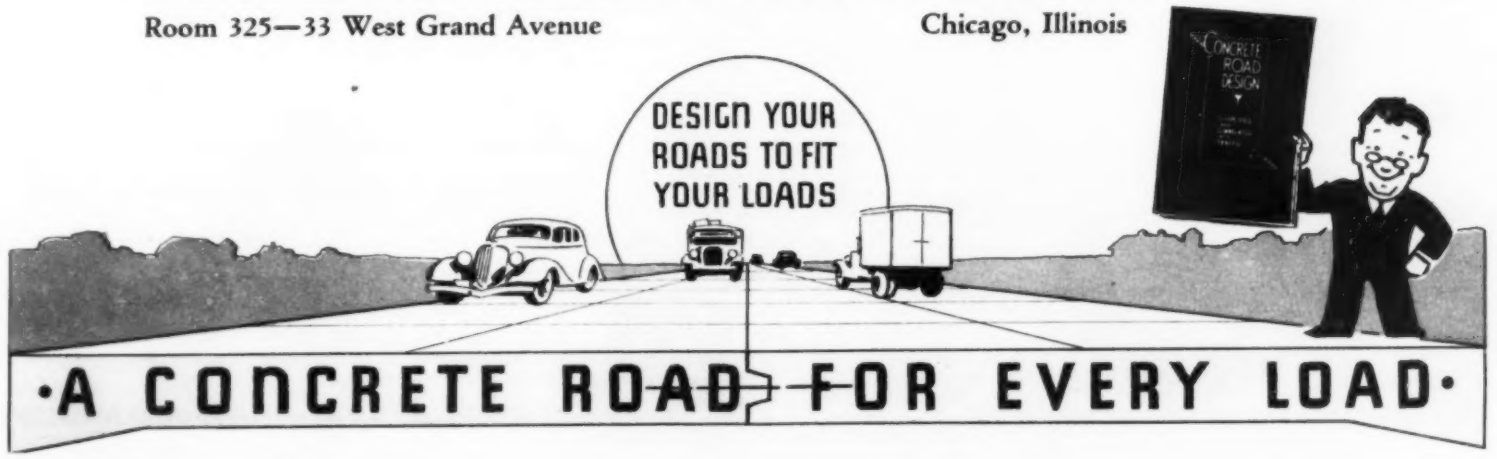

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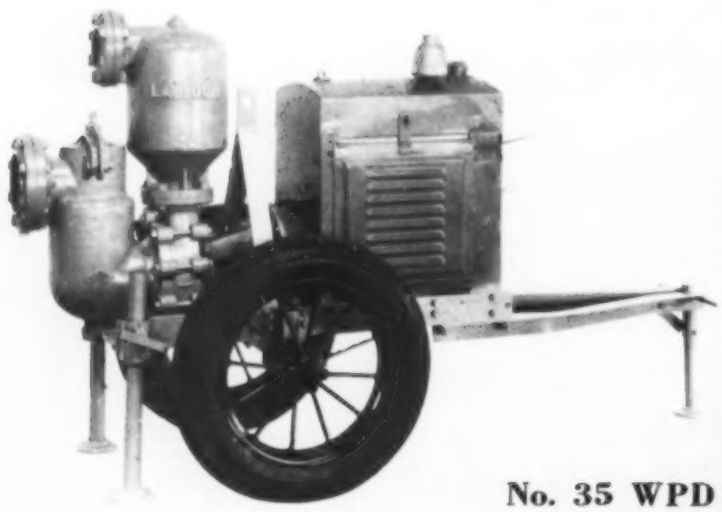

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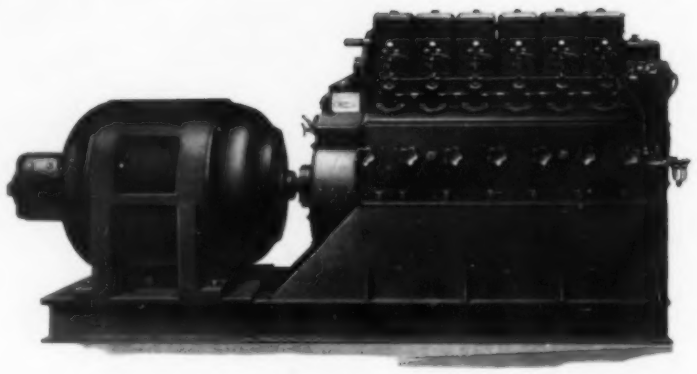

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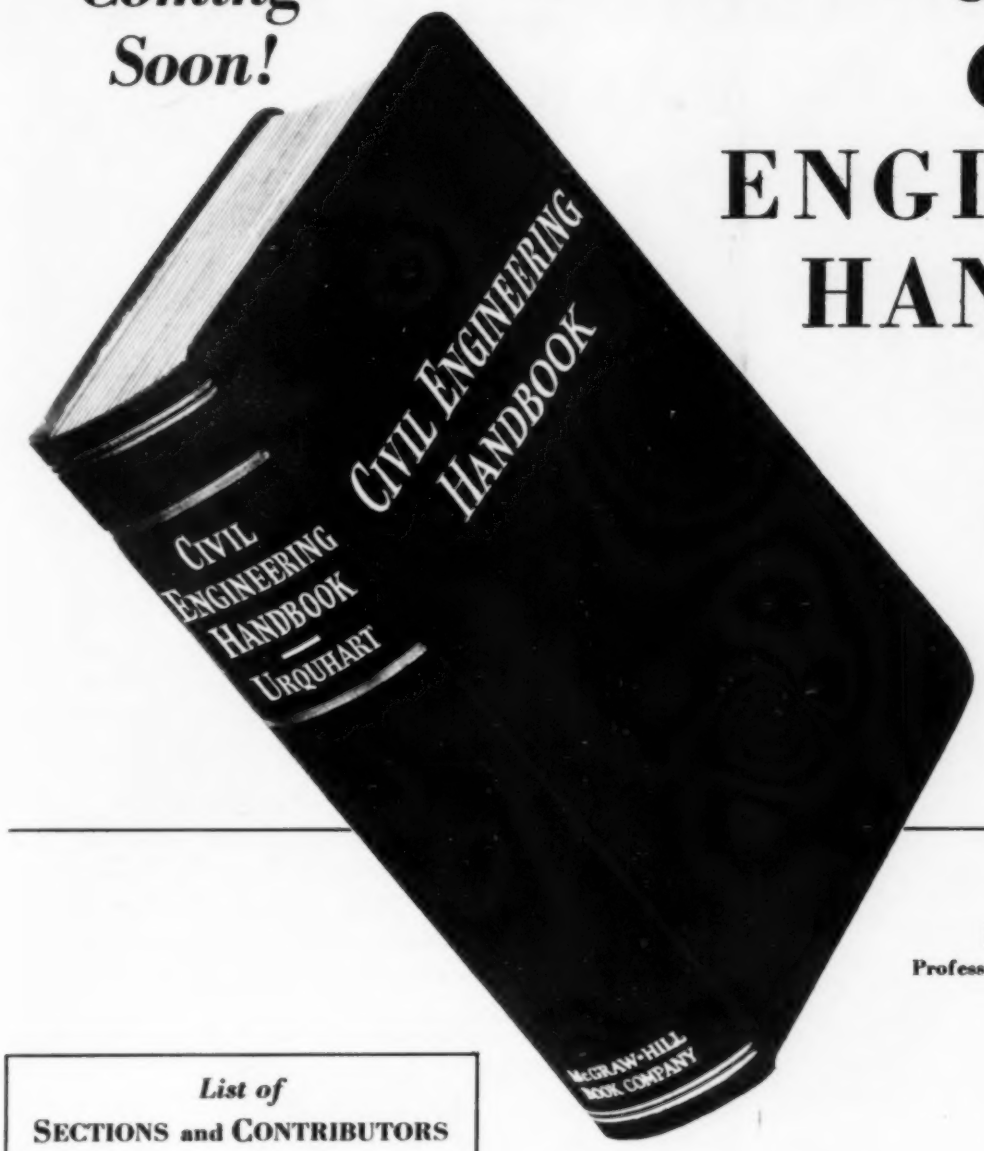

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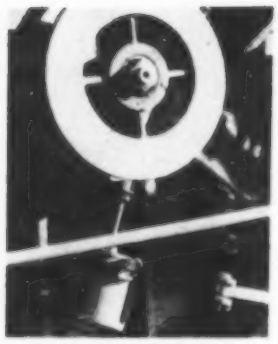

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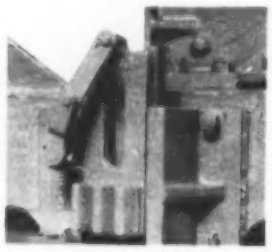

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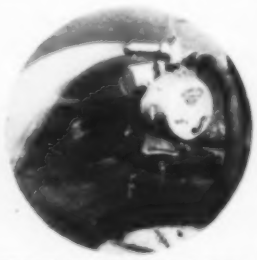

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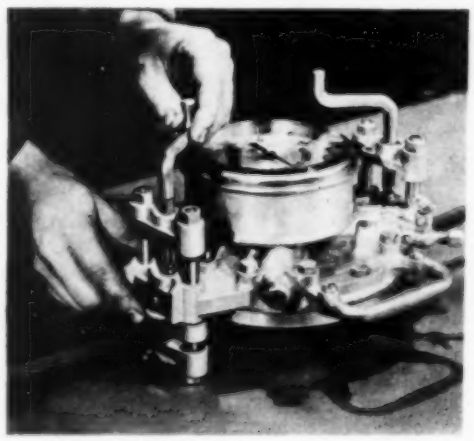

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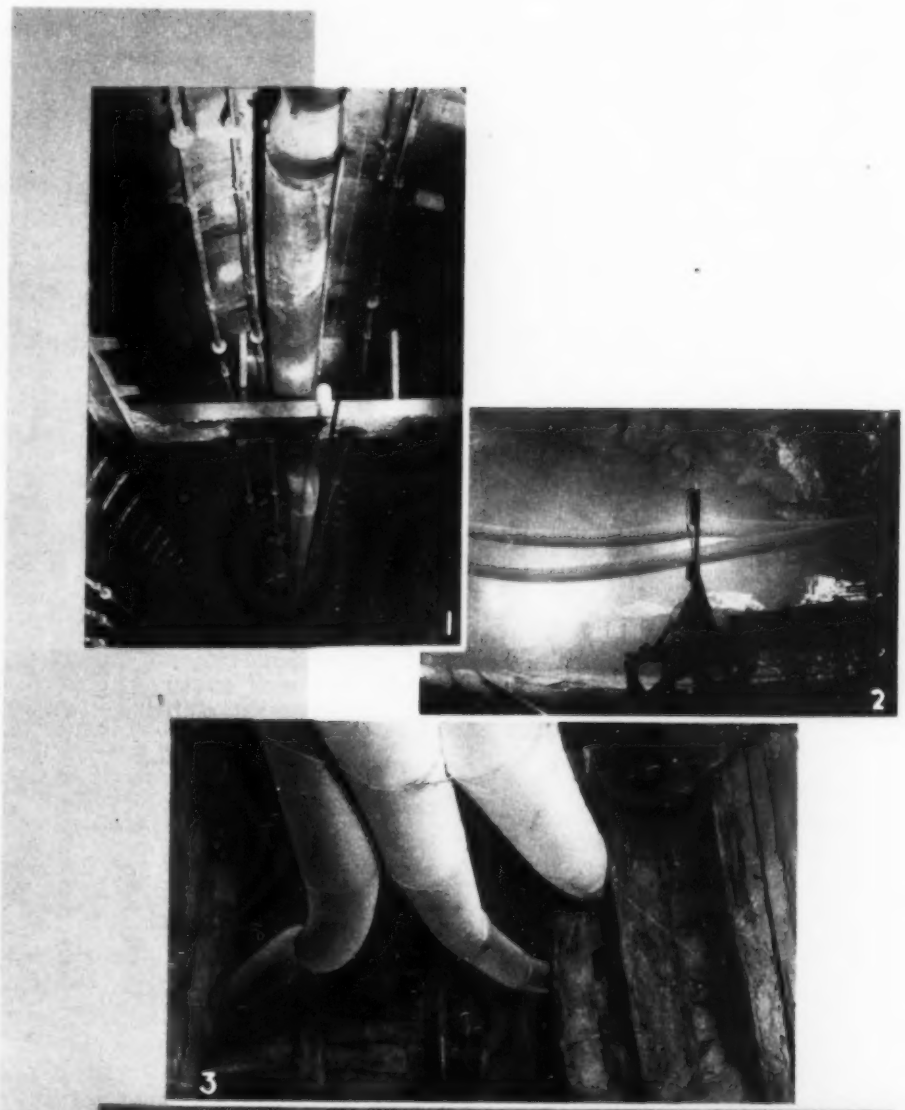

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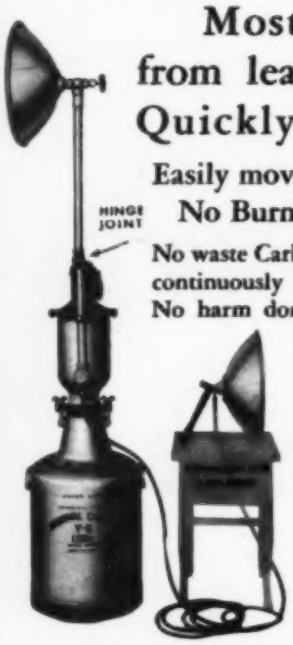

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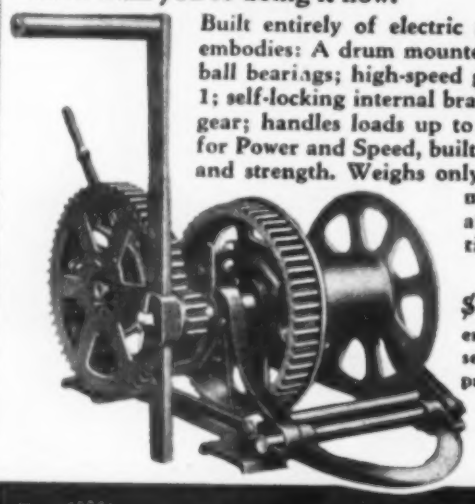

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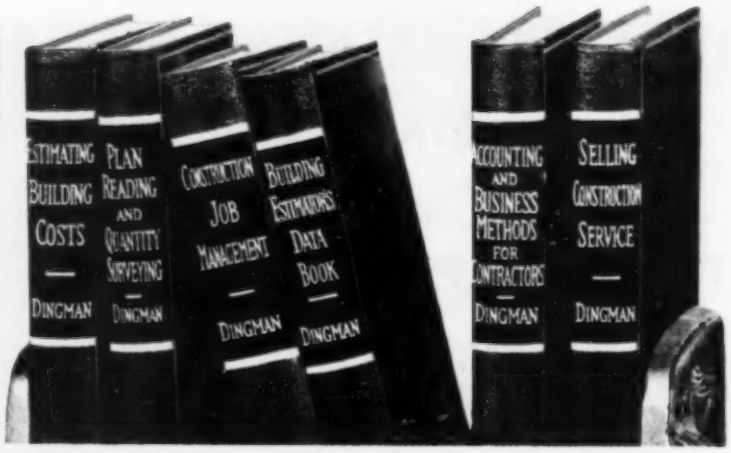

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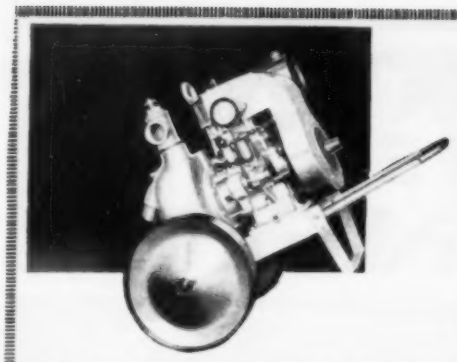

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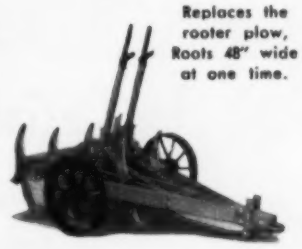

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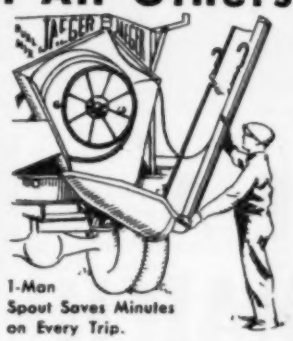

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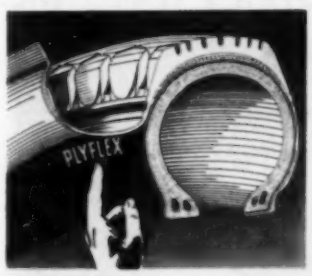

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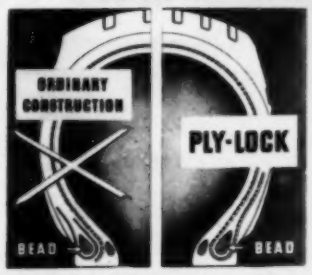

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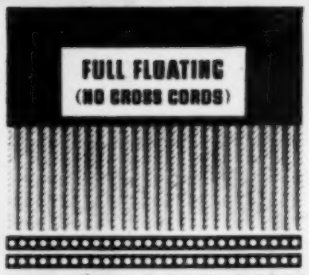

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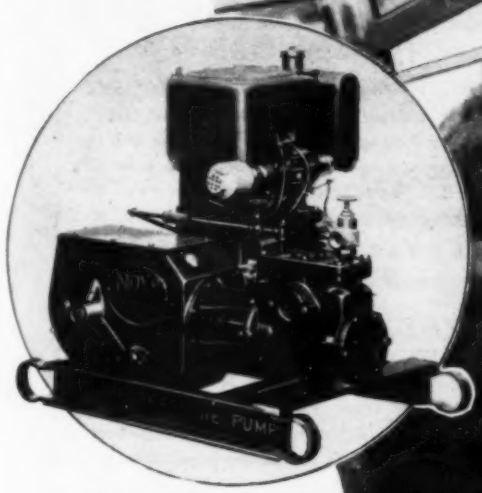

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Construction Methods

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To keep in touch with the items brought to your attention here, make a habit of checking this page each issue.

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